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Analysis of Operating Alternatives for Market Street Trolley Coach Lines

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Transit Planning Section
June 1975

Analysis of Operating Alternatives for Market Street Trolley Coach Lines



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Transit Planning Section
June 1975

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Executive Summary

The Market Street Beautification Project has, through its proposal to remove overhead trolley wires, raised doubts about the continued operation on Market Street of five major Municipal Railway trolley coach lines. These lines carry over 17 million passengers annually, an average of almost 50,000 per day--nearly 10% of the entire system patronage.

The Railway has open to it several alternate ways to deal with the problem of operating the Market Street trolley coach lines:

- continued trolley coach operation on Market Street of lines 5, 6, 7, 8 and 21;
- application of the Kinetic Energy Wheel to lines 5, 6, 7, 8 and 21;
- truncating lines 5, 6, 7 and 21 at Market, with turnback loops via Mission Street; dieselizing the #8;
- re-routing lines 5, 6, 7 and 21 onto Mission; dieselizing the #8;
- re-routing lines 5, 6, 7 and 21 onto Howard and Folsom Streets, dieselizing the #8;
- re-routing lines 5, 6, 7 and 21 onto Sutter and Post Streets; dieselizing the #8.

In addition, there is possible a variation of some of the above, in which as an alternative to dieselization, the 8-Market would be retained as a trolley coach on Upper Market, then diverted via Duboce Avenue to Mission Street for the downtown segment of its run.

These alternatives have been evaluated for their impacts on the Municipal Railway, the travelling public and the operating environment of the lines; the analyses and conclusions are contained in this report. Generally, all of the alternatives which require removing or re-routing lines 5, 6, 7, 8, and 21 from Market Street are unacceptable in terms of cost, reliability of operations, service to the passenger and integrity of the urban environment. Accordingly, we recommend that proposals to re-route or de-electrify the Market Street segments of trolley coach lines 5, 6, 7, 8 and 21 be rejected.

With regard to the possibility of Kinetic Energy Wheel installation, such an application might be used sometime in the future to permit removal of wires on Market Street, although the range envisioned for KEW-equipped vehicles, about two miles, would dictate retention of wire west of Van Ness Avenue. At present there is no empirical evidence on which to base estimates of the cost or operational reliability of the KEW system. A decision on its appropriateness for use on major MUNI trunk lines 5, 6, 7, 8 and 21 would require as a pre-

requisite the demonstration of its operability elsewhere; Market Street is not the place for an experiment of this kind.

The only adequate solution is therefore the retention of trolley coach operation on Market Street. Deterioration of the temporary wooden poles and the aesthetic requirements of a beautified Market Street demand a new overhead installation, suspended insofar as possible from eyebolts rather than poles. We recommend that detailed engineering for a modern trolley overhead installation, based on the foregoing principle, begin at once, and that it be followed by rapid installation.



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Introduction

Continued operation on Market Street of five heavily patronized Municipal Railway trolley coach lines is in doubt. Lines 5-McAllister, 6-Masonic, 7-Haight, 8-Market and 21-Hayes carry more than 17 million passengers annually, or 9.6% of the MUNI total. On an average, this means nearly 50,000 passengers per day, a figure probably exceeded on week days. Design plans for the Market Street Beautification Project call for removal of overhead wire required by these lines on the grounds that it conflicts with visual design standards set for the thoroughfare. This paper considers these standards and the various operating alternatives open to the Municipal Railway, and evaluates them in terms of operations, impacts on service and environmental effects.

The Market Street Question

The removal of overhead trolley coach wire from Market Street is a product of the Market Street Beautification Project. This Project was initiated in the mid-1960's to take advantage of the installation of BART as an opportunity to beautify and renovate Market Street into an exciting and glamorous boulevard for San Francisco. A Project Staff was assembled and a Design Plan developed; a Summary Report was published on November 6, 1967. A price tag of \$24.5 million was attached to the Project, which went before the voters as Bond Proposition A at the election of June 4, 1968, and was approved. Adminis-

tration of the Project became the responsibility of the Transit Task Force.

The important ramifications of changes in Market Street -- MUNI's major artery -- on the Railway were not discussed in the Summary Design Plan. The only reference to overhead wire is a single listing under "First Stage Actions":

4. Restricting all transit vehicles to those not requiring overhead trolley wires.

(This language was later incorporated into Board of Supervisors Resolution 116-68; see Appendix J). It is possible that at this time the Project was relying upon the recommendations made by the Northern California Transit Demonstration Project, and included in its Final Report, "Coordinated Transit for the San Francisco Bay Area -- Now to 1975," prepared by the firm of Simpson and Curtin, and published in October 1967. This report recommended dieselization of most of the Municipal Railway's trolley coach routes, including the five Market Street lines. The report was poorly received, and most of its recommendations subsequently disavowed. In reaction to it, the Public Utilities Commission affirmed a strong stand in favor of electric transit in a 1969 resolution (Appendix E).

Policy Questions

In the intervening years, the Market Street Beautification Project has continued under the assumption that the overhead wires could come down. MUNI has not made any definite plans for this situation; it has investigated the possible use of a Kinetic Energy Wheel (Alternative B), but as yet

no firm policy decision has been made.

The city's policy on this issue is both ambivalent and vague.

There is first the aesthetic question, which led to the proposed removal of wires. It has been alleged that this was the main selling point of the bond issue, for example, by Mr. Jack M. Barron, Transit Task Force Project Manager, in his March 8, 1972 letter to the Clerk of the Board of Supervisors in response to a question on the wire removal policy (Appendix F). However, as noted, the Market Street Design Plan Summary Report made only one short reference to this issue. This reference was incorporated almost verbatim into Board of Supervisors Resolution 116-68, adopted on February 13, 1968 (Appendix J). But examination of the text of the argument for Proposition A -- the Market Street Bond Issue -- as included in the official election pamphlet by a unanimous vote of the Board of Supervisors taken only two months after passage of Resolution 116-68, shows that there is no mention of the removal of trolley coach overhead (Appendix G).

Some four years later, in March 1972, the Board approved a resolution submitted to it by the Transit Task Force (Resolution 392-72) dealing with the design for Upper Market Street, and stating as a matter of policy its intention to:

"Avoid plans for transit use of Upper Market Street which would

4

require utilization of overhead trolley wires on Lower Market Street." (Appendix H).

But the Transit Task Force itself compromised this policy at meetings of the Mayor's Committee on Upper Market Street, held in March and April 1975. The Task Force has now agreed to the strengthening of the Path of Gold poles, or to provision for adequate substitutes, for the purpose of supporting trolley coach overhead at all areas of Upper Market for which it is now actively planning.

While Market Street design work was proceeding, the Public Utilities Commission had taken a strong stand in favor of electric transit in a resolution of November 25, 1969. The official resolution directed the Public Utilities Commission staff to emphasize electric transit in the operations of the Municipal Railway (Appendix E).

On April 27, 1972, the City Planning Commission adopted the Plan for Transportation element of the Comprehensive Plan. Under General Objective 2, Policy 3: Reduce Pollution and Noise, the Plan noted the environmental superiority of electric transit vehicles and stated that, pending the development of a new technology, "...the City should extend its commitment to an electrical transit system." More recently, as part of the Plan for Transportation Noise Control, the Planning Commission adopted a policy urging the retention and

expansion of the electric trolley network:

"Electric trolley buses are quiet, economical and relatively pollution-free in their use. These benefits outweigh the adverse environmental impact of power generation or fossil fuel utilization. Electric trolleys should be retained where feasible and consideration should be given to electrifying selected existing diesel bus routes."

MUNI's Options

Given the rather ambivalent nature of City policy on this issue, the Municipal Railway has an obligation to its passengers to examine the various alternatives for operating trolley coach routes 5, 6, 7, 8 and 21, to evaluate them for operability, service characteristics and environmental impact, and to determine which offers the best opportunity for public service within legitimate financial and environmental constraints.

The Alternatives were originally developed by senior MUNI staff. Each is examined according to a standard format to facilitate comparison. Because there is such a variation in capital and operating costs, all costs have been determined for a uniform 20-year operating period in terms of present dollars. Design lives of 10 years for diesel buses, 20 years for trolley coaches and 30 years for overhead are assumed, as are an interest rate of 6 1/2% and an inflation rate of 6%. Capital

costs of \$60,000 for a diesel bus and \$100,000 for a trolley coach are assumed, as is a nominal \$45,000 per year average present operating cost per vehicle. Unit costs of overhead are shown in the text. For the purposes of this analysis, the operating cost of the trolley coach and the diesel bus are assumed to be equal. It has been assumed that any Alternative employing operation on Market Street would require a rebuilding of the trolley coach overhead over the relevant portion of the street. It should be noted that the costs reflected in this paper are the estimated incremental capital and operating costs required to implement the Alternative, not the total cost.

The evaluation format is as follows:

1.0 Operations Impacts

- 1.1 Capital Costs
- 1.2 Operating Costs
- 1.3 Recapitulation of Estimated Added Costs
- 1.4 Schedule Adherence

Note: these are the incremental costs of the alternative for a 20-year operating period.

2.0 Service Impacts

- 2.1 Accessibility
- 2.2 Travel Time
- 2.3 Reliability

3.0 Environmental Considerations

- 3.1 Noise
- 3.2 Air Pollution
- 3.3 Visual Intrusion
- 3.4 Second-order Effects

The evaluation format is presented in the form of a summary evaluation matrix at the conclusion.

Alternative A: Trolley Coach Operation on Market Street (Figure 1)

Under this alternative, trolley coach routes 5-McAllister, 6-Masonic, 7-Haight, 8-Market and 21-Hayes would continue to use the surface of Market Street for their Downtown distribution and collection segments. Modern trolley coaches for these lines are on order, and deliveries should start about the end of the year. The overhead wires on Market Street, however, have been subjected to intensive use over almost 25 years, and have been continually re-patched and relocated during the BART construction period. The running wires and suspension facilities (cables, poles, eyebolts, etc.) should be replaced with the most modern and least visually objectionable equipment available; this would be adequate for operation of these lines for another thirty years.

1.0 Operations Impacts1.1 Capital Costs

a. Alternative A does not require the purchase of any additional rolling stock. A number of trolley coaches of the most modern design available from a North American manufacturer are under construction by Flyer Industries of Winnipeg; these will be adequate to provide peak capacity on all MUNI trolley coach lines.

b. Based on an estimate prepared for the Municipal Railway by Hetch-Hetchy Water and Power, the installation of modern trolley coach overhead on Market Street would cost \$1,672,720. (Appendix A). At

6 1/2% interest, the annual payment over the 30-year assumed life of the overhead would be $\$1,672,720 (.07658) = \$128,096.89760$.

The present value of these payments for a 20-year operating period would be: $\$128,096.89760 (11.0185) = \$1,411,435.67$.

c. The cost estimate prepared by Hetch-Hetchy assumes that the overhead will be strung to the inside of the new Market Street traffic signal standards, toward the middle of the street. Previously expressed fears that the wire and the standards would conflict appear to have been groundless; at locations where the new standards are already installed the wires are already strung towards the middle of the street and are being successfully operated.

1.2 Operating Costs

a. Exclusive of inflation, which affects all alternatives, this alternative does not require any increase in platform cost.

b. For the purposes of this analysis it is assumed that the operating costs of diesel buses and trolley coaches are equal.

1.3 Recapitulation of Estimated Added Costs

1.1 Capital: Overhead Replacement:	\$1,411,435.67
1.2 Operating:	<u>0</u>
TOTAL:	\$1,411,435.67
USE:	\$1,500,000.00

EXISTING OR
KINETIC ENERGY
WHEEL

FORT MASON
 409
 U.S. MILITARY RESERVE

21



SAFETY

1.4 Schedule Adherence

a. As construction related to BART and Market Street beautification subsides, operating problems for MUNI surface transit vehicles will diminish somewhat. However, Market Street must by its nature function as a major trunk routing for MUNI, and accordingly transit priority measures will probably be required to ensure the proper functioning of transit. This is completely consistent with the designation of Market Street as "transit street" in the Plan for Transportation element of the Comprehensive Plan for San Francisco.

2.0 Service Impacts

2.1 Accessibility

a. As at present, accessibility to jobs, retail establishments, cultural and entertainment facilities will be excellent with a Market Street routing. The lines under consideration are among the oldest in the City; Downtown San Francisco grew up around these lines. Their continued high patronage for nearly a century testifies to the soundness of the routing and the high level of accessibility they offer to transit patrons.

b. Accessibility to regional transit facilities will be excellent with a Market Street routing. Alternative A will provide the most direct access to BART for patrons and potential patrons of lines 5, 6, 7 and 21. Alternative A will provide convenient access

to Golden Gate Transit, and the expanded Golden Gate Ferry service. The walk from Market Street to Mission would remain for those transferring to AC Transit at the East Bay Terminal, but this would presumably be offset by the better access to BART which will be increasingly important as BART becomes fully operational. Access to Greyhound at Seventh Street will remain good. Access to Southern Pacific Peninsula Service will continue to require, as for all the Alternatives, one transfer.

2.2 Travel Time

Alternative A offers the best overall travel times of any Alternative, although they would presumably be equaled by Kinetic Energy Wheel (Alternative B) operation.

a. Travel times to and from Civic Center would be about the same for Alternative A as for the other Alternatives (provided that frequency of service were not reduced).

b. Market Street operation offers the shortest rush hour travel times to the retail and commercial core area of Downtown for patrons of lines 5, 6, 7 and 21 (except that a transfer to MUNI METRO would give an equally short travel time to the basement level of stores with entrances in the concourse of Powell Street Station). In the off-peak period, Market Street operation is faster and direct routing becomes even more advantageous.

c. Of all the Alternatives, Alternative A and B offer the

shortest rush-hour travel times to the Financial District for patrons of lines 5, 6, 7 and 21, although a transfer to Muni Metro at Civic Center could offer a three minute time saving to and from locations in the immediate vicinity of subway station entrances. Alternatives A and B would, in that case, offer the best transfer arrangements with Muni Metro.

2.3 Reliability

a. Reliability will be good with this alternative, especially if a permanent scheme for transit priority is developed for Market Street. Turns and crossings are few; routings are direct; opportunities for breakdowns of schedules are minimized.

b. The attractiveness of the service possible with a Market Street routing means that patronage should remain high. The long-term viability of the routes in question is therefore good.

3.0 Environmental Considerations

3.1 Noise

a. Operation of trolley coaches rather than diesel buses will minimize the noise impact on Market Street.

A transit noise level survey was conducted for the MUNI in March of this year by the City Department of Public Health. (Appendix B) This study, based on rush-hour recordings made on Market and Mission

Streets, determined that the minimum recorded peaks for diesel buses were slightly higher than for streetcars (74 vs. 72 decibels) and significantly higher than for trolley coaches (74 vs. 69 decibels). The maximum peaks, however, probably recorded during vehicle acceleration, showed an even larger noise difference: 92 decibels for diesel buses versus a maximum of 84 for trolley coaches and streetcars. This difference is more significant than immediately apparent because sound pressure levels (in decibels) are measured on a logarithmic scale. This means that an increase of ten decibels on the scale represents a tenfold increase in sound energy transmitted, and roughly a doubling of perceived loudness. A difference of eight decibels for accelerating diesel buses therefore means a significant difference in noise produced in a street environment.

Continued operation of trolley coaches would make it possible to keep the number of diesel buses operating on Market Street from increasing; with further electrifications, some reduction in diesel volumes would be possible. However, re-routing trolley coaches off Market Street would lead to an increase in diesel bus volumes and noise.

3.2 Air Pollution

Overall, Alternative A would minimize diesel bus pollutants

produced on Market Street by continuing to rely heavily on electric propulsion. Weekday diesel bus mileage would be kept to 1029.2. Based on the average per-vehicle-mile emission rates for 1973 determined by the Bay Area Air Pollution Control District, estimated weekday diesel bus pollutant production on Market Street is:

<u>Pollutant</u>			<u>Quantity Produced</u>
Particulates	(1029.2 miles)	$\left(\frac{1.5 \text{ grams}}{\text{mile}}\right)$	= 1,543.8 grams
Organics	(1029.2 miles)	$\left(\frac{1.7 \text{ grams}}{\text{mile}}\right)$	= 1,749.6 grams
NOx (Nitrogen Oxides)	(1029.2 miles)	$\left(\frac{52 \text{ grams}}{\text{mile}}\right)$	= 53,518 grams
SO ₂ (Sulfur Dioxide)	(1029.2 miles)	$\left(\frac{0.7 \text{ grams}}{\text{mile}}\right)$	= 720.4 grams
CO (Carbon Monoxide)	(1029.2 miles)	$\left(\frac{30 \text{ grams}}{\text{mile}}\right)$	= 30,876 grams

3.3 Visual Intrusion

Operation of trolley coaches on Market Street will have the highest visual impact of the alternatives. It is for this reason that the Market Street Beautification Project calls for the removal of trolley coaches and their overhead wires.

As noted in section 1.1 of this alternative, continued trolley coach operation would require installation of new overhead wire. By using the most modern installation techniques, reducing special work to a minimum and suspending wires from eyebolts in buildings rather than from poles in the sidewalk, the visual intrusion can

be minimized; it would, however, still exist. Much of the criticism of overhead trolley lines is due to the prominence of heavy overhead feeder cable, strung parallel to the trolley wire itself. Market Street trolley overhead is "fed" principally from other trolley lines and from underground distribution lines. Where new feeder cable is needed for the Market Street lines, it can be placed underground to minimize visual impact; the cost for this item is included in the Hetch-Hetchy cost estimate (Appendix A).

3.4 Second-Order Effects

Because this alternative offers excellent access to downtown activities of all sorts and to regional transit connections, it has good potential--given transit priority measures--to attract additional passengers and to help shift the modal balance from autos to transit. It therefore has a potentially good second-order environmental impact.

B. KINETIC ENERGY WHEEL (Figure 1)

The Kinetic Energy Wheel (KEW) is a device which can be fitted to electric transit vehicles, such as the trolley coach, to store energy in the form of a spinning flywheel. In a trolley coach this flywheel would be "charged" while the trolley coach was connected to overhead wires--either while running on its route or standing still. Then, over some portions of the route without overhead wires, the trolley poles would be lowered, and the spinning flywheel--now connected to an electrical generator--would provide enough power to propel the trolley coaches over the non-electrified section.

Kinetic Energy Wheels have been tried in buses in Europe and Africa, and a trial installation has been made in a New York subway car. As the potential for application of such a device to the Market Street trolley coach lines is obvious, a study of its feasibility in MUNI operation, funded by the Urban Mass Transportation Administration and the San Francisco Public Utilities Commission, was begun by Lockheed Missiles and Space Co. Because of study cost increases and, more importantly, escalation of the projected per-bus KEW installation cost from \$15,000 to \$40-45,000, the contract with Lockheed was terminated. The study was continued under a contract with consulting engineers Louis J. Lawson and John M. Woods, in the hope that a less expensive means of fitting a Kinetic Energy Wheel to a

trolley coach could be found. The Lawson-Woods report was submitted to the Public Utilities Commission on May 13, 1975; the cost and operational data used here are derived from that report.

1.0 Operations Impacts

1.1 Capital Costs

a. The "Recapitulation and Analysis of Schedules" for January 20, 1975, published by MUNI's Schedule and Traffic Department, puts peak vehicle requirements for the Market Street trolley coach lines as follows:

<u>Lines</u>	<u>Trolley Coaches</u>
5-McAllister	27
6-Masonic	32
7-Haight	20
8-Market	18
21-Hayes	18
	<hr/> 97 total

10 spares (10%) would put the overall total vehicle requirement at 107.

The present Lawson-Woods estimate of the cost of a Kinetic Energy Wheel, installed, is \$20,772. It is assumed that its life would be the same as the trolley coach in which it would be installed, or 20 years. (In fact, the KEW assembly and other electrical equipment could probably be salvaged at the end of the operating period).

On this basis, installation of Kinetic Energy Wheels to 107 trolley coaches for Market Street operation would cost

	\$20,772
x	107
	\$2,222,604.
Contingencies (max. 10%)	220,000.
TOTAL:	\$2,442,604.

Regrettably there is no actual KEW installation bid against which to judge the accuracy of this cost estimate. If the Lockheed estimate of \$40-45,000 were applied to Market Street, the cost would double from \$2.4 million to \$4.8--\$5.4 million (including a contingency allowance).

b. The energy storage capability of the KEW is estimated by Lawson and by Woods to be 7.5 KWH. Inasmuch as a trolley coach requires about 3.5 KWH per mile for propulsion, on average, the KEW equipped vehicle would have a range of two miles without wires after charging. The distance from the Ferry to Van Ness Avenue is almost exactly two miles. Assuming KEW-equipped trolley coaches were recharged at the Ferry, they would have to be recharged or run from overhead upon reaching Van Ness. As the complete recharging time would require about two minutes, and since trolley coaches run frequently at this point, it would not be possible to have trolleys stop to recharge at Van Ness; it would therefore be necessary for

them to return to overhead operation at this point. Alternative B would therefore require installation of overhead on Market Street from Van Ness west. Using the Hetch Hetchy estimate for Market Street overhead, less the cost of wire and special work east of Van Ness, would put the cost as follows (assuming 2/3 of material east of Van Ness, 1/3 west):

1/3 itemized materials = 1/3 (\$1,236,820) = \$412,273.

+ special work west of Van Ness = 63,600.

TOTAL: \$475,873.

+ Contingencies (10%) = 47,600.

+ Engineering (10%) = 47,600.

TOTAL: \$571,073.

At 6 1/2% interest, the annual payment over the 30-year assumed life of the overhead would be:

\$571,063 (.07658) = \$43,732.00454.

The present value of these payments for a 20-year operating period would be:

\$43,732.00454 (11.0185) = \$481,861.09.

c. The recharging process for Alternative B would presumably take place at the Ferry. As this would occur during the normal recovery allowance, there would be no additional running time or vehicles required. However, charging stations would have to be installed at the Ferry. Assuming four DC charging stations would be necessary, and taking the Lawson-Woods estimate of \$1,935 each,

the cost would be:

	\$1,935.
	<u>x4</u>
	\$7,740.
+Contingencies (max.10%)	<u>.700.</u>
	\$8,440.

The Woods-Lawson study assumes a 30-year life for charging stations. At 6 1/2% interest, the annual payment over the 30-year life would be:

$$\$8440 (.07658) = \$646.33520$$

the present value of these payments for a 20-year operating period would be:

$$\$646.33520 (11.0185) = \$7,121.64$$

1.2 Operating Costs

It is assumed for the purposes of this analysis that the operating cost of the trolley coach and the "hybrid" vehicle operated partly from overhead and partly by KEW are equal. Basically this means that the savings from not having to maintain the Market Street overhead will be assumed to be offset by the extra cost of operating

and maintaining the KEW system of 107 vehicles.

1.3 Recapitulation of Estimated Added Costs

1.1 Capital: KEW installation	\$2,442,604.00
Overhead	481,861.09
4 charging stations	7,121.64

1.2 Operating	0.
Total	\$2,931,586.73
Use	\$3,000,000.

1.4 Schedule Adherence

As there is no North American operating experience with KEW vehicles, one cannot say for certain what the effects of operation in San Francisco will be. We can assume for the purpose of this analysis that the pole retrieval and placement operation will not take more than one minute overall per round trip, and will be partly offset by coinciding with a revenue passenger stop. If we also take as given that for this alternative to work at all the operation of the kinetic energy wheel itself and the wire retrieval and place-

ment apparatus must be satisfactory, then there is every reason to believe that the simplicity and reliability of KEW operation will be as good as that of trolley coach operation on Market Street.

2.0 Service Impacts

2.1 Accessibility

a. Under this alternative, accessibility to jobs, retail establishments, cultural and entertainment facilities will be excellent.

2.2 Travel Time

Overall travel time with the KEW alternative should be almost the same as the Market Street trolley coach alternative. It is assumed that the pole retrieval and placement operation can coincide with a revenue passenger stop, and will not add significantly to passenger trip time.

2.3 Reliability

Once again it is difficult, in the absence of relevant operational experience, to make a statement about

the operating characteristics of the kinetic energy wheel. Certainly if it performs as it is supposed to, the "hybrid" trolley/KEW alternative should be as reliable as or perhaps even more reliable than all-trolley coach operation. For the purposes of this analysis we will assume that the reliability characteristics of Alternatives A and B are equally good.

3.0 Environmental Considerations

It is in the environmental aspects of transit operation that the advantages of the KEW-equipped vehicle are most apparent... Only this alternative scores highly in all environmental categories.

3.1 Noise

KEW operation should be as quiet as trolley coach operation.

3.2 Air Pollution

Being electrically powered, the KEW-equipped vehicle will not pollute its operating environment. The air quality characteristics of Alternative B are therefore the same as those of Alternative A.
(See p. A-1.)

3.3 Visual Intrusion

a. Reduction of visual impact is, of course, the "raison d'etre" of the KEW-equipped vehicle. Successful KEW operation would make it possible to retain electric operation on Market Street while removing overhead wires east of Van Ness Avenue.

b. Alternative B would not reduce the visual intrusion of Market Street overhead west of Van Ness Avenue.

c. Alternative B would not reduce the visual intrusion of trolley coach overhead crossing Market Street at:

- Main-Drumm and Davis-Beale.
- Third-Kearny and Stockton-Fourth
- Van Ness Avenue

3.4 Second - Order Effects

In common with Alternative A (Market St. trolley coach operation), the excellent service characteristics of the KEW alternative should make it possible to exploit some of the passenger attraction

potential of transit. A modal shift from automobiles to electric transit would, of course, be environmentally beneficial.

Another second-order effect would be the ability to use the KEW for auxiliary power in emergencies--off-wire detours, etc.--on those vehicles so-equipped.

C. Market Street Turnback-Loops via Mission Street (Figure 2)

Under this proposal, the 8-Market trolley coach line would be dieselized; the 5-McAllister, 6-Masonic, 7-Haight and 21-Hayes trolley coach lines would no longer run down Market Street through Downtown, but instead would terminate at Market, using loops via Mission Street to reverse direction. Specific routings would be as follows:

5-McAllister: Inbound as now via McAllister and Hyde, then across Market, south on Eighth, east on Mission, north on Seventh, across Market, then on Seventh Street north to McAllister and outbound as at present.

6-Masonic and 7-Haight: Inbound as now via Haight, Laguna and Page, then diverting north on Octavia to Grove, east on Grove, across Market at Marshall Square, south on Eighth, west on Mission, north on Ninth, across Market to Hayes, west on Hayes, south on Gough, then west on Haight outbound as at present.

21-Hayes: Inbound as now via Hayes, Laguna and Grove, then continues east on Grove to Marshall Square, across Market, south on Eighth, west on Mission, north on Ninth, across Market to Hayes, then outbound as at present.

1.0 Operations Impacts

This proposal was originally conceived as a means for terminating trolley coach operation on Market by forcing through passengers to transfer to MUNI METRO at Civic Center. More recent evaluation of probable Muni Metro patronage suggests that there may not be a sufficient comfortable capacity available at this point in the morning rush hour for any substantial number of passengers to board. In the evening peak, under this proposal, there would be a large number of passengers boarding Muni Metro on lower Market Street for travel only as far as Civic Center; it is likely that prospective through Muni Metro passengers would find difficulty boarding their cars because much space would be used up by passengers transferring to the 5, 6, 7 and 21 trolley coach lines at Civic Center.

Another difficulty with the proposed transfer operation is that the outbound routing of lines 6, 7 and 21 via Ninth and Hayes Streets is not adjacent to any subway entrance. Passengers transferring from Muni Metro to one of these lines would have to walk, on the average half the length of Civic Center station, surface at Marshall Square/Eighth Street, walk a long Market Street block to

Figure 2

TURNBACK AT MARKET

TROLLEY
COACH LINES

ROUTE 8.
(DIESEL)





Larkin, cross Larkin, and then walk up Hayes to the nearest stop. Because of the left-turning movement from Ninth into Hayes, the overhead would be far enough out over Ninth Street to preclude a stop at the southeast corner of Ninth and Market. (The inbound transfers for routes 6, 7 and 21, and in both directions for the 5-McAllister would be better located.) This is too great a distance to be an effective and attractive transfer for Muni patrons.

Other considerations beside the expected heavy longer-distance loads would work to depress transfer traffic to Muni Metro from these trolley coach lines. It is not likely, for example, that given the longer access and egress times to and from subway entrances and station platforms that there would be significant time savings over the use of surface transit for such a short distance.

It is concluded that, under this alternative, some additional surface transit capacity would be required to accommodate passengers desiring to continue their journey down Market Street. Based on passengers counts conducted on lines 5 and 21, an estimated 75% of the passengers on board the routes in question at Van Ness Avenue in the evening peak hour have come from east of Civic Center (Appendix D). Assuming that a third of these passengers

manage to transfer to Muni Metro or walk to their destination, east of Jones Street, then a surface capacity equal to one-half the present Market Street capacity provided by these routes would be required. This would impose on the Railway a capital cost for the acquisition of additional diesel buses for Market Street surface operation.

1.1 Capital Costs

a. Presently lines 5, 6, 7 and 21 offer a combined evening rush hour outbound volume east of Jones of 58 trolleys, with a peak 20-minute rate of 75 per hour. The most economical way to provide a 50% equivalent capacity would be to run a Van Ness to Ferry Shuttle service as a #8 turnback with a peak hour service rate of 20 vehicles per hour or about a two-minute headway. Given a rush-hour round trip time of about 46 minutes including recovery time, some 25 additional diesel buses would be required. At a present cost of \$60,000 per bus, this would represent an immediate capital requirement of \$1,380,000.

It is assumed for the purposes of this analysis that the average design life of a diesel bus is ten years, and of a trolley coach 20 years. (In fact, in current MUNI operations both these design lives are exceeded.) Midway through a 20-

year operating period it will be necessary to purchase a new fleet of diesel buses to replace the original 23. This cost is converted into a present value and included in the capital cost of Alternative C.

The determination of this cost is made difficult by unpredictable fluctuations in the rates of interest and inflation. On the one hand the cost of diesel buses has been increasing rapidly--from some \$51,000 last summer to over \$60,000 now. Naturally such extreme increases cannot be expected to go on indefinitely. However, if we take a conservative inflation rate of 6% per year, a bus that costs \$60,000 today would cost \$107,450.86 in 1985. 23 of these buses, to replace the fleet that would have to be purchased now to provide surface capacity on Market Street, would cost \$2,471,369.78 ten years from now. The present value of that fleet today, using a municipal bond rate of 6 1/2% would be \$1,316,565.04. The total cost of the 23-bus fleet for a 20-year operating period would therefore be: $\$1,380,000 + \$1,316,565.04 = \$2,696,565.04$.

b. The 3-Market line requires 20 trolley coaches for evening rush hour operation. Assuming that diesel bus and trolley coach performance are equal, i.e. that they can be

substituted with no variation in cost on a one-for-one basis, and allowing 10% or two buses for spares, dieselization of the 8-Market would require the purchase of 22 buses. Allowing for a replacement fleet midway through a 20-year operating period, 6% inflation, and converting future costs to a present value, the total capital cost to dieselize the 8-Market line would be: \$1,320,000 + \$1,259,321.19 = \$2,579,321.19.

c. There will be a cost to the City for modifying the trolley coach overhead to connect the Haight and Hayes lines via Octavia and Gough, to extend wires on Grove to Hyde, and to provide wire and special work on Seventh, Eighth and Mission Streets to enable the turn-back loops to be made.

The estimated requirements are:

11,400 feet of grooved trolley wire @ \$1.60 per foot	= \$ 18,240
3 electric switches @ \$3,500 each	= \$ 10,500
4 trailing frogs @ \$1,800 each	= \$ 7,200
2 crossovers @ \$2,000 each	= \$ 4,000
40 poles with bracket assembly @ \$2,500 each	= \$100,000
9 spans @ \$400 each	= <u>\$ 3,600</u>
Material Subtotal	\$143,540

Material Subtotal	\$143,540
Engineering (10%)	\$ 14,354
Contingencies (10%)	<u>\$ 14,354</u>
Total	\$172,248

At 6½% interest, the annual payment over the 30-year assumed life of the overhead would be:

$$\$172,248 (.07658) = \$13,190.75184$$

The present value of these payments for a 20-year operating period would be:

$$\$13,190.75184 (11.0185) = \$145,342.30$$

1.2 Operating Costs

a. Turning back trolley coach routes 5, 6, 7 and 21 at Market Street will shorten the lines by slightly under a mile. This will mean that fewer trolley coaches will be required to operate these lines at present service levels.

Existing round-trip travel times in the evening rush hour between Civic Center and the outer terminals, excluding recovery time at Civic Center, would be approximately as follows:

<u>Route</u>	<u>Round-trip Running Time</u>
5	65 minutes
6	69 minutes
7	48½ minutes
21	60 minutes

Based on maintaining the existing evening peak scheduled service west of Civic Center, and based on an analysis of present rotation sheets (operating staff schedules for a route), we estimate the following vehicle savings would be possible:

<u>Route</u>	<u>Present Vehicle Requirements</u>	<u>Alt. C Vehicle Requirements</u>	<u>Savings</u>
5	27	20	7
6	19	16	3
7	12	8	4
21	18	14	4
		Total	18

A total of 18 rush hour vehicles and drivers could be saved by turnback operation. The greatest relative saving would be on the 7-Haight, which has the greatest proportion of its route on Market. Relatively, the least saving would occur on the long 5-McAllister line, with proportionately the least

amount of Market Street running. (Note that these savings may be overstated since they assume no additional running time for the diversion of the Haight lines (6 and 7) via Octavia, Grove, and Hayes).

b. More than offsetting these operating savings will be the added operating cost of the 23 diesel buses needed for Market Street service. If we assume that a diesel bus and a trolley coach have the same operating cost then there is a net increase in operating cost for $23 - 18 = 5$ vehicles.

A low estimate of the annual operating cost for a motor coach would be \$45,000. Using a conservative annual inflation rate of 6%, a current municipal bond rate of $6\frac{1}{2}\%$, and a 20-year operating horizon, the present value of the operating cost of a vehicle for twenty years would be \$860,967 (Appendix D). The additional operating cost of Alternative C for twenty years would be $5 (\$860,967) = \$4,304,835$.

c. Most passengers who have a choice will prefer a through ride to a transfer if that choice is available. It is therefore very likely that termination of routes 5, 6, 7 and 21 at Civic Center would cause a heavy diversion of

passengers to paralleling through diesel routes 31, 66, 71 and 72. This would lead to a requirement for more diesel buses on these lines.

Inasmuch as such a diversion would reduce the requirements for the local replacement diesel bus service on Market Street needed for local and transfer passengers left stranded by shortening of the trolley coach lines, it will be assumed here that there would be a one-for-one tradeoff. For example, addition of one diesel bus to the 66 line would release one diesel bus from the Market local, so that there would be no additional operating or capital cost for diesel buses above those already accounted for.

This diversion will mean lower ridership on trolley coach routes 5, 6, 7 and 21, and that, in turn, will lead to reductions in service provided on those lines. In turn, this service reduction will further reinforce diversion of passengers to diesel lines. The conclusion is inescapable that partial dieselization, which is what the truncated trolley coach service alternative represents, really means a strong shift in emphasis from electric to

diesel transit. This would appear to conflict with established city policy favoring retention and extension of electric transit. (Appendix E).

d. There will be some difficulty in finding a suitable downtown recovery point for trolley coaches under this alternative. Trolleys could layover at Marshall Square, taking curb space on Grove and on Hyde Streets. Outbound passengers boarding here would be forced to take a three-block detour before heading off in the desired direction. From purely service considerations, a layover at the outbound transfer point would be better. In the case of the 5-McAllister, this would mean blocking a lane on Seventh Street or Seventh North; for routes 6, 7 and 21, space would be required on Hayes behind Civic Auditorium. The latter is, as noted, a poor transfer point for BART and Muni Metro passengers.

1.3 Recapitulation of Estimated Added Costs

The estimated total added cost of Alternative C in present dollars for a 20-year operating period, assuming 6% inflation, 6½% interest, a 20-year design life for trolley coaches and a ten-year design life for diesel buses

1.1 Capital:	23 diesel buses for 20 years	=	\$2,696,563.04
	22 diesel buses for 20 years	=	\$2,579,321.19
	Overhead modifica- tion	=	<u>\$ 145,342.30</u>
	Subtotal Capital	=	\$5,421,226.53
1.2 Operating:	5 extra vehicles for 20 years	=	<u>\$4,304,835.</u>
	Total	=	\$9,726,061.53
	Use	=	\$9,800,000.

1.4 Schedule Adherence

a. Under this alternative it will be difficult to provide adequate passing facilities to permit "juggling" trolley coaches at the downtown terminus. To affect the sequence of trolley coaches it will either be necessary to build a stretch of passing wire, or else resort to a lot of time-consuming pole-pulling. There is no obviously self-recommending location on the proposed turnback loops for either of these. It is likely that these difficulties would adversely affect maintenance of schedules.

b. The turnbacks proposed envision the merging of a large number of looping trolley coaches from lines 5, 6, 7 and 21 into the Mission exclusive transit lane for one block, then diversion north to Market. This will be an

extremely difficult operation during rush hours because of intensive use of both transit and traffic lanes.

In the case of lines 6, 7 and 21, which will loop south on Eighth, west on Mission and north on Ninth, the problem will be to merge an evening peak flow of 33 trolleys per hour into the Mission transit lane's 61 trolleys and buses per hour, a total of 99 in the block from Eighth to Ninth with an almost inoperable peak 20-minute rate (expressed hourly) of 124. The 38 turnback trolleys per hour will, after squeezing into the exclusive lane for about a 400-foot run, have to diverge to the right, fight their way across the remaining traffic lane and into the right-turn lane in order to turn north into Ninth Street; heading north on Ninth, the trolleys will have to merge left across two or three lanes in order to be in position to turn left across Market into Hayes and finally stop behind Civic Auditorium. These maneuvers will all take place under conditions of severe congestion, exacerbated by traffic from the new State Compensation Building at Ninth and Market and the Bank of America Service Center at Tenth and Market.

Similarly, the 5-McAllister will have to jockey into position for a left turn from Eighth into Mission Street,

only to be faced with another left turn--this time opposing outbound Mission Street traffic with all the opportunities for delay to the 5 and to the Mission lines--into Seventh, then on Seventh, possibly with a stop at Market, Seventh North and into McAllister. Again, all of this will have to take place under conditions of severe congestion.

Operation under these conditions lends itself easily to schedule disruption and general unreliability.

2.0 Service Impacts

2.1 Accessibility

a. Turning back trolley coaches at Civic Center will result in a severe decrease in no-transfer accessibility to jobs, cultural facilities and entertainment, and retail shopping. Passengers now transferring to these lines for the trip to destinations east of Civic Center will be faced with a second transfer, highly objectionable in most cases, or a switch to another route. This is particularly bad for shopping trips because it is more awkward to climb on and off transit vehicles and work push-type rear doors when one's arms are full of packages.

b. Passengers using crosstown and North-South lines east of Civic Center (25-Bryant, Powell Cables, 30-Stockton, Third Street

lines 15 and 42, 41-Union, 32-Embarcadero) and wishing to use lines 5, 6, 7 or 21 will have to transfer twice. This is a very bad system design feature which (1) contravenes the basic design concept of the MUNI as incorporated in the Transportation Element of the Master Plan, and (2) will probably destroy transfer traffic between these now heavy lines, since only a fraction of passengers can be induced, under normal circumstances, to transfer twice.

The net result of this will be to reduce loadings on the truncated lines, probably on the crosstown and North-South lines, and to diminish the quality of the transit alternative in general.

2.2 Travel Time

Travel time will vary for passengers depending upon the location of their downtown trip origin or destination and the mode used for the Market Street portion of their journey.

a. Generally, passengers using surface transit to continue their trip down Market Street will be faced with longer travel times than they now enjoy. In some cases, however, particularly for destinations west of Third Street, these travel times will probably still be faster than the Muni Metro transfer option.

b. In the retail area around Powell Street Station, the Muni

Metro transfer option will equal all-trolley coach rush-hour travel times to and from the basements of stores with entrances in the concourse of Powell Street station. To other destinations in the retail area, passenger travel times overall will be longer by any combination of routes than by the present direct trolley coach service. This is true even without weighting the Civic Center transfer times for their nuisance value to passengers.

During off-peak periods, the direct trolley coach service is faster, while trips on the Muni Metro transfer option, because of headway limitations in the Market Street subway, cannot be made any more quickly.

c. Financial District passengers with trip origins or destinations in the immediate vicinity of subway station entrances will have shorter travel times with a transfer to Muni Metro than by the present all-trolley coach service. Whether these rush-hour passengers would consider a three-minute saving worth the inconvenience of the transfer is debatable.

For many Financial District destinations--particularly those approximately equidistant from subway stations--travel times would not be significantly different than those now experienced by through trolley coach patrons. Only for Lower Market Street destinations

served by the Muni Metro Embarcadero Station would the Muni Metro transfer likely offer a worthwhile travel time saving over present rush-hour trolley coach operation. It is for destinations in this area that we would presumably expect a large proportion of transfers to Muni Metro rather than surface transit.

2.3 Reliability

The complicated turnback movements and the route diversions on lines 6 and 7 offer ample chance for service breakdowns that will decrease the reliability of service to the patron. Presumably this could be partly offset for some passengers by the higher reliability of the Muni Metro subway operation; however, many passengers would continue to use surface modes and would have to put up with diminished service reliability without any compensating gain.

3.0 Environmental Considerations

3.1 Noise

Any reduction of trolley coaches operated in the central business district will mean an increase in noise from diesel operation.

Because of the stop-and-go nature of Downtown traffic and transit operation, pedestrians on Market Street would, under this alternative, be subjected to frequent peaks of noise from diesel bus acceleration. Diesel bus noise would vary with the point of impact on Market Street.

Estimated volumes of diesel buses on various segments of Market Street would be as shown on the following chart:

--From the Ferry to Fremont Street*

	INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing	12	15	32	42	44	57	82	63
+Dieselized #8 16		12	18	24	34	36		
+ #8 Turnback 30		30	30	30	60	60		
Total Alt. C 58		57	80	96	138	153	26	24

--From Fourth to Fifth

	INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing	18	21	32	42	50	63	72	57
+Dieselized #8 16		12	18	24	34	36		
+ #8 Turnback 30		30	30	30	60	60		
Total Alt. C 64		63	80	96	144	159	25	23

--From Fremont to Third

	INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing	32	36	63	87	95	123	38	29
+Dieselized #8 16		12	18	24	34	36		
+ #8 Turnback 30		30	30	30	60	60		
Total Alt. C 78		78	111	141	189	219	19	16

* expressed hourly

As the charts indicate, Alternative C would result in a very frequent passage of diesel buses--and resultant frequent production of high noise peaks--over most of beautified Lower Market Street. The increase in noise produced by diesel buses would, in some cases, be dramatic. At the foot of Market, below Fremont Street, rush hour noise production due to diesel buses would more than triple; from an average frequency of 82 seconds to a diesel bus every 26 seconds. Similarly, in the retail core of Market from Fourth to Fifth Streets, diesels would increase from one every 72 seconds on an average, to one every 25 seconds, on average, for the full evening rush hour. The worst situation would exist on the section of Market Street from Fremont to Third, where the 38-Geary line would add to the diesel bus noise volume; here, present noise production would double in the evening rush hour--from an average diesel bus frequency of one every 38 seconds to an average of one every 19 seconds for a full hour.

These figures do not reflect noise produced by diesel buses crossing Market Street, such as those on the 15-Third and Kearny, 42-Third and Evans and 30-Stockton Express lines.

Upper Market

With the exception of some routes crossing or terminating at Market Street, Upper Market is now free of diesel buses. This would

be changed by Alternative C, which envisions dieselization of the 8-Market line; and one-for-one replacement would result in a combined inbound and outbound evening rush hour volume of 34 diesel buses, an average frequency of one diesel bus every 1 3/4 minutes for a full hour.

3.2 Air Pollution

Alternative C would maximize reliance upon diesel propulsion in the downtown area, and minimize the use of trolley coaches. Accordingly it would have the largest increase of weekday diesel bus mileage operated on Market Street--from 1029.2 miles to 2771.8 miles, an increase of 169.3%. Based on the per-vehicle-mile emission rates for 1973 determined by the Bay Area Air Pollution Control District, estimated weekday diesel bus pollutant production on Market Street would increase as follows:

<u>Pollutant</u>	<u>Present</u> <u>(Alternatives A,B)</u>	<u>Alternative</u> <u>C</u>
Particulates	1,543.8 grams	4,157.7 grams
Organics	1,749.6 grams	4,712.1 grams
NOx (Nitrogen Oxides)	53,518 grams	144,134 grams
SO ₂ (Sulfur Dioxide)	720.4 grams	1,940.3 grams
CO (Carbon Monoxide)	30,876 grams	83,154 grams

3.3 Visual Intrusion

a. Alternative C would reduce the visual impact of transit on Market Street by removing the on-street overhead wires.

b. Alternative C would not result in any substantial change in the visual environment of Mission Street

c. Alternative C would cause visual intrusion on some streets where trolley wire would have to be installed:

--on Octavia from Page to Grove

--on Gough from Hayes to Haight

--on Grove from Polk to Hyde

--on Seventh from Mission to Market

d. Alternative C would not reduce the visual intrusion of trolley coach wires crossing Market at:

--Main-Drumm and Davis-Beale

--Third-Kearny and Stockton-Fourth

--Hyde-Eighth and Ninth-Hayes

--Van Ness Avenue

--Church Street

e. Alternative C would install an additional overhead crossing of Market at Seventh Street, causing visual intrusion at that point.

3.4 Second-order Effects

The overall effect of Alternative C would be to severely reduce the potential of lines 5, 6, 7 and 21 to perform a useful function within the system of MUNI lines. The addition of a second transfer for most patrons, the poor line location for subway-surface transfers, and the increased travel time in the

discretionary retail shopping market would result in a patronage shift to through diesel routes and would diminish MUNI's potential for attracting patrons out of their automobiles. This would result in a loss of opportunity to reduce downtown noise and air pollution, parking space demand, and transportation energy requirements.

D. Reroute Trolley Coaches Via Mission Street To The Ferry (Figure 3)

This proposal was devised as a way to reconcile the divergent aims of removing trolley coach wire from Market Street and maintaining east-west trolley coach service through the downtown area; inasmuch as trolley coach operation is to be maintained on Mission Street, Alternative D envisions a re-routing of the downtown leg of routes 5, 6, 7 and 21 from Market to Mission Street. As originally conceived, this alternative included dieselization of the 8-Market trolley coach line. A more recent variation including a lower Mission routing for the 8-Market trolley coach line is examined as Alternative G.

Trolleys would be rerouted under Alternative D as follows:

5-McAllister: Inbound as now via McAllister and Hyde, then across Market, south on Eighth, east on Mission to the Ferry; return westbound on Mission to Seventh, north on Seventh, across Market, then on Seventh Street North to McAllister and outbound as at present.

6-Masonic and 7-Haight: Inbound as now via Haight, Laguna and Page, then diverting north on Octavia to Grove, east on Grove, across Market at Marshall Square, south on Eighth, east on Mission to the Ferry; return west on Mission to Ninth, north on Ninth, across

Market to Hayes, west on Hayes, south on Gough to Haight, then west on Haight outbound as at present.

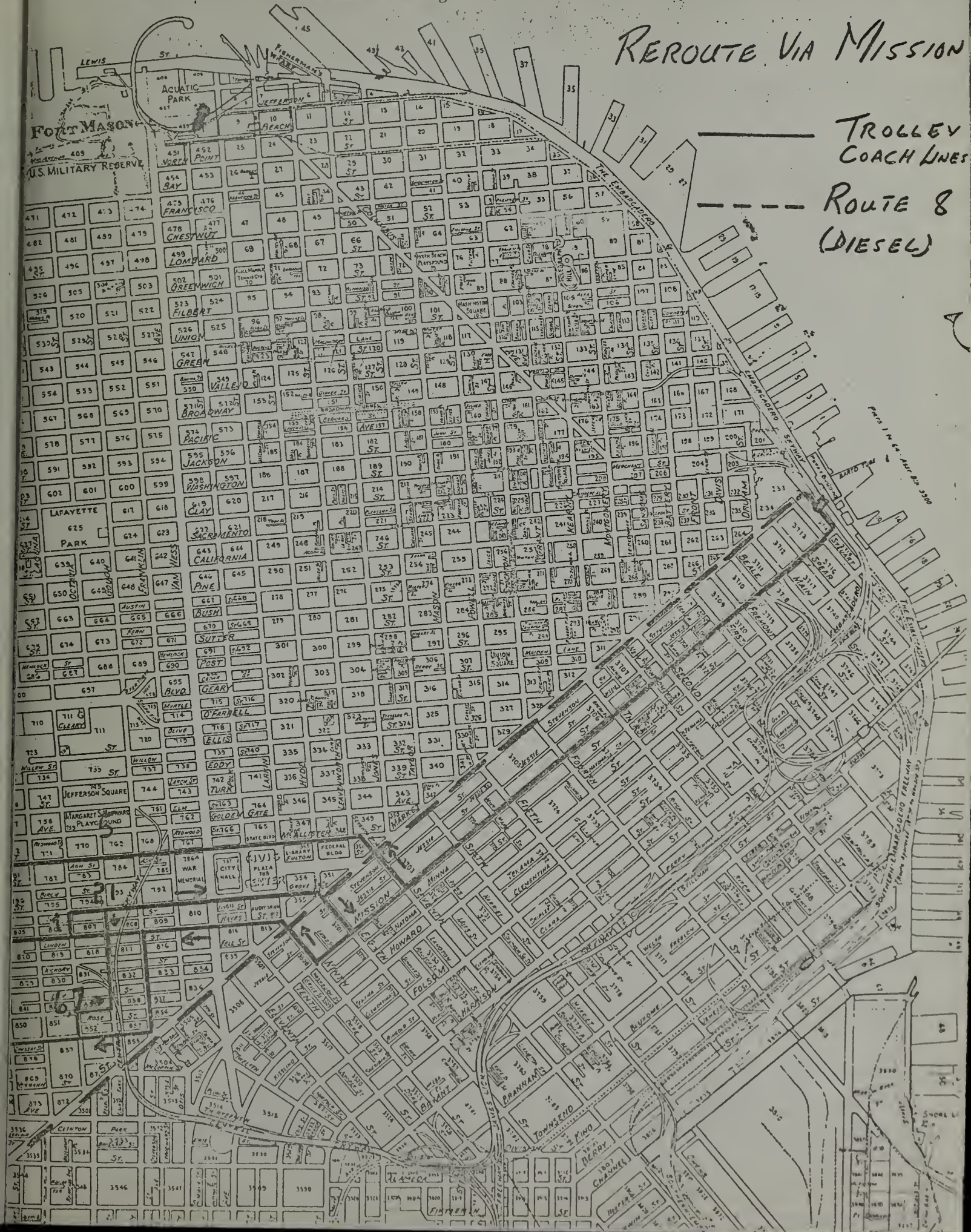
21-Hayes: Inbound as now via Hayes, Laguna and Grove, then continuing east on Grove to Marshall Square, across Market, south on Eighth, east on Mission to the Ferry; return west on Mission to Ninth, north on Ninth, across Market to Hayes, then outbound as at present.

Figure 3

REROUTE VIA MISSION

TROLLEY
COACH LINES

ROUTE 8
(DIESEL)



1.0 Operations Impacts

The tortuous re-routing required to enable trolley coaches on lines 5, 6, 7 and 21 to gain access to Mission Street will result in added running time. This will mean more trolleys required to maintain service levels.

It is difficult to determine precisely what additional running time requirements will be; the situation will be complicated by unknowns: operation on new streets and by the transit priority treatment on Mission Street. However, the MUNI Transportation Department, based on their experience, has furnished what is considered to be its best estimate.

Increase in running time under this alternative results from three parts of the operation:

1. Additional running time due to realignment of routes north of Market Street (this applies to lines 6 and 7);
2. Additional running time due to the distance from Market to Mission Streets (this applies to lines 5, 6, 7 and 21);
3. Additional running time due to transit congestion on Mission Street (this applies to lines 5, 6, 7 and 21, and also to Mission trolleys 9, 12 and 14).

Taking these individually:

1. The realignment of routes 6 and 7 via Octavia and Grove inbound, and Hayes and Cough outbound is estimated to require an additional 4 minutes per round trip in the peak period.
2. The running time for the block from Market to Mission should be approximately one minute in each direction.

3. Additional running time due to congestion on Mission Street is harder to determine. The Transportation Department's estimate is based on a review of existing service levels on Mission Street which indicates a rush hour (4:30-5:30 P.M.) flow of 61 trolley coaches and diesel buses, with a peak 20-minute (4:50-5:10 P.M.) rate of 79 per hour from Second Street to South Van Ness. The aggregate rush hour flow for Market Street trolley coaches on routes 5, 6, 7 and 21 based on present schedules, is 58 per hour between the Ferry and Seventh Street, with a peak 20-minute rate of 75 per hour. If these rush hour volumes were to be combined on Mission Street, the rerouting would cause a flow of $61 + 58 = 119$ trolley coaches and diesel buses per hour, or one every 30 seconds. This is greater than the present peak bus and trolley coach flow on Market Street. However, the operating situation would be very much worse as the peak 20-minute rate would be $79 + 75 = 154$ buses and trolley coaches per hour--a volume which is probably inoperable in a single lane.

To make possible the maintenance of a semblance of service it would be necessary to remove diesel bus lines from Mission Street. It will be assumed that lines 11 and 26 would be shifted to Market Street, and that the 14 Express, 14 Guerrero Limited and 26-Express would be discontinued upon inauguration of full BART service. These lines have a combined rush hour flow of 27 buses per hour, and a peak rate of 40 buses per hour. The removal of diesel buses would leave a net rush hour flow on Mission Street of $119 - 27 = 92$ trolley coaches per hour, or an average headway of slightly less than 40 seconds, and a peak 20-minute rate of $154 - 40 = 114$ trolleys per hour, or a peak headway of 32 seconds. Based on this estimated trolley coach flow, the MUNI Transportation Department estimates a net increase in rush hour running time of six minutes per round-trip in the segment of joint operation with the existing Mission trolleys (from the Ferry to Ninth Street); as the 5 line would turn off Mission

at Seventh Street, there is assumed for it an increase of only five minutes.

The estimated evening rush-hour round-trip running times over the downtown segment of the routes, and comparisons with present running times, are as follows:

5-McAllister

- | | |
|--|---------------|
| a. Present: 8th and Market to Ferry, and return to Jones and Market | 34½ min. |
| b. Alternative D: 8th from Market to Mission | 1 min. |
| 8th and Mission to Ferry (including 3 minute congestion delay factor) | 13½ min. |
| Recovery time | 3 min. |
| From Ferry, on Mission to Seventh (including 2 minute congestion delay factor) | 15½ min. |
| 7th from Mission to Market | <u>1 min.</u> |
| TOTAL: | 34 minutes |
| c. Difference: ½ minute decrease | |

6-Masonic and 7-Haight

- | | |
|--|---------|
| a. Present: Haight and Laguna to Ferry and return | 47 min. |
| b. Alternative D: Haight and Laguna to Eighth and Market | 8 min. |
| Eighth from Market to Mission | 1 min. |

Eighth and Mission to Ferry (including 3 minute congestion delay factor)	13½ min.
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Recovery time	1 min.
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From Ferry on Mission to Ninth (including 3 minute congestion delay factor)	18½ min..
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Ninth from Mission to Market	1 min.
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Ninth and Market to Haight and Laguna	<u>7 min.</u>
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TOTAL:	50 min.
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c. Difference: 3 minute increase

9 Richland, 12-Ocean and 14-Mission

Ninth and Mission to Ferry and Return	6 min. increase
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21-Hayes

a. Present: Van Ness and Grove/Hayes to Ferry and Return	43 minutes
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b. Alternative D: Van Ness and Grove to Eighth and Market	2½ min.
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Eighth from Market to Mission	1 min.
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Eighth and Mission to Ferry (including 3 minute congestion delay factor)	13½ min.
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Recovery time	4 min.
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From Ferry, on Mission to Ninth (including 3 minute congestion delay factor)	18½ min.
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Ninth from Mission to Market	1 min.
------------------------------	--------

Ninth and Market to Van Ness
and Hayes

2 min.

TOTAL: 42½ minutes

c. Difference: ½ minute decrease

Based on these changes in running times, the number of additional trolley coaches required would be as follows:

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
<u>ROUTE</u>	<u>INCREASE IN P.M. PEAK ROUND-TRIP RUNNING TIME (MINUTES)</u>	<u>P.M. PEAK HEADWAY*</u>	<u>$\frac{b}{c}$ = ADDITIONAL TROLLEYS REQUIRED</u>
5-McAllister	(½ decrease)	3	0
6-Masonic	3	4	1
7-Haight	3	6	0
9-Richland	6	8	1
12-Ocean	6	6	1
14-Mission	6	3	2
21-Hayes	(½ decrease)	5	0
TOTAL:			<u>5</u>

* From "Recapitulation and Analysis of Schedules" (January 20, 1975)
Municipal Railway Schedule and Traffic Department.

1.1 Capital Costs

a. As indicated, five additional trolley coaches would be required to maintain existing service levels on the lines listed.

However, dieselization of the 8-Market trolley coach line would free

20 trolley coaches in the P.M. peak for service on Mission Street. Assuming a 20-year design life for a trolley coach, there would be no increase in capital costs for additional trolleys to be used on the rerouted and Mission Street lines during a 20-year operating period.

b. Dieselization of the 8-Market trolley coach line will require the purchase of more diesel buses. The MUNI Schedule and Traffic Department's current "Recapitulation and Analysis of Schedules" indicates that this line requires 20 trolleys in the evening peak. Assuming a 10% requirement for spares, and assuming that diesel buses and trolley coaches have similar operating characteristics, then a total of 22 additional buses would be required to dieselize the #8 line. At an estimated \$60,000 per diesel bus for orders placed now, this would mean an immediate capital expense of $22 \times \$60,000 = \$1,320,000$.

Assuming a ten year design life for diesel buses, a second fleet of 22 buses would be required midway through a 20-year operating period. However, these diesel buses would cost considerably more than \$60,000 because of the effect of ten years of inflation. Assuming a conservative 6% inflation rate, a diesel bus which would cost \$60,000 in 1975 would cost \$107,450 in 1985. 22 of these buses would cost \$2,363,900 in 1985. The net present cost of this fleet today, using a municipal bond rate of $6\frac{1}{2}\%$, would be \$1,259,321.19. The total net present cost to dieselize the 8-Market

would therefore be:

\$1,320,000.00
+ 1,259,321.19
<u>\$2,579,321.19</u>

c. There would be a cost to the City for modifying the overhead system so that trolley coaches might reach and leave Mission Street. The Haight and Hayes lines would have to be connected via Octavia and Gough, overhead extended on Grove from Polk to Hyde, and wire and special work constructed on Seventh, Eighth and Mission Streets. The estimated requirements are:

12,100 feet of grooved trolley wire	
@ \$1.60 per foot	= \$ 19,360
3 selectric switches @ \$3,500 each	= 10,500
4 trailing frogs @ \$1,800 each	= 7,200
1 crossover @ \$2,000 each	= 2,000
46 poles with bracket assembly	
\$2,500 each	= 115,000
3 poles @ \$2,000 each	= 6,000
3 spans @ \$400 each	= <u>1,200</u>

MATERIAL SUBTOTAL:	\$161,260
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Engineering (10%)	16,126
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Contingencies (10%)	<u>16,126</u>
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TOTAL:	\$193,512
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At $6\frac{1}{2}\%$ interest, the annual payment over the 30-year assumed life of the overhead would be:

$$\$193,512 \quad (.07658) = \$14,819.14896.$$

The present value of these payments for a 20-year operating period would be:

$$\$14,819.14896 \quad (11.0185) = \$163,284.79.$$

d. The increased running time which would result from the re-routing of the trolley lines, and the longer walking distance between the rerouted lines and major Downtown destinations would mean increased overall travel times for users of lines 5, 6, 7 and 21. Some passengers with the opportunity to do so would switch from these lines to paralleling diesel lines with a more direct routing. This, in turn, would lead to a requirement for more diesel buses and hence an increase in the capital cost of Alternative D. However, because of the difficulty of estimating this cost, it is omitted from the recapitulation; this should not be taken as an inference that the Municipal Railway would not be faced with these costs. Increased running times for Mission trolleys could similarly result in a slight diversion to diesel lines or BART; this is not included in the cost figures of this analysis.

1.2 Operating Costs

a. The additional trolleys placed in operation to maintain

present service levels on lines 6, 9, 12 and 14 will impose additional operating costs on the Railway. Taking the figure of five additional trolleys, a conservative present average annual operating cost of \$45,000 per trolley, an annual inflation rate of 6%, and a municipal bond rate of $6\frac{1}{2}\%$ per annum, the present value of the operating cost of a vehicle for a 20-year operating period would be \$860,967 (Appendix D). The additional operating cost of Alternative D for 20 years would be $5 (\$860,967) = \$4,304,835$.

b. For the purpose of this analysis it is assumed that the operating costs of a diesel bus and a trolley coach are the same, and that therefore there would be no added cost to run the 8-Market as a diesel bus line.

1.3 Recapitulation of Estimated Added Costs

The estimated total added cost of Alternative D in present dollars for a 20-year operating period, assuming 6% inflation, $6\frac{1}{2}\%$ interest, a 20-year design life for trolley coaches and a ten-year design life for diesel buses, is:

1.1 Capital:	22 diesel buses for 20-years:	\$2,579,321.19
	Overhead modification:	<u>163,284.79</u>
	Subtotal Capital :	\$2,742,605.98
1.2 Operating:	Five additional vehicles for 20 years:	\$4,304,835.00
	TOTAL :	\$7,047,440.98
	USE :	\$7,100,000.00

1.4 Schedule Adherence

The application of transit priority measures to Mission Street was intended to improve the reliability and speed of operation there. Alternative D will largely negate their beneficial effect on Muni operations.

a. The present peak volume of transit vehicles on Mission is 61 trolleys and buses per hour, with a 20-minute peak rate of 79 per hour. Assuming all diesel buses were removed and trolley lines 5, 6, 7 and 21 were rerouted onto Mission, the transit volume would increase to 92 trolley coaches per hour, with a peak 20-minute rate of 114 trolleys per hour; these represent headways of 40 and 32 seconds, respectively. This is shorter than most of the traffic signal cycles on Mission Street so that bunching and queueing of trolleys will result.

b. The 90-foot loading islands designed for the Mission Street transit priority program can accommodate only two trolley coaches simultaneously. A cursory examination of rush hour operation on Mission and Market streets, however, shows that triple-stopping is a common practice. This will no longer be possible, and will further aggravate the lineup of trolleys waiting to make passenger stops.

c. Presently "leap frogging" of trolleys and diesel buses is a part of regular operations. A vehicle not making a stop can usually pass another which is stopped for passengers if one of the

vehicles is a diesel; the second vehicle in a double-length stop can often, if it is finished loading or unloading passengers first and if one of the vehicles is a diesel, pull out and continue on its way. Leap frogging would no longer be possible if all trolley coaches were rerouted onto Mission Street, even though the high transit volume there would make it more necessary. This would make schedule maintenance more difficult.

d. Outbound #5 trolleys will be faced with difficult operational problems in trying to make the right turn into Seventh Street; similarly outbound #6, 7 and 21 trolleys will have trouble turning right onto Ninth.

In both cases, trolleys will merge to out of the exclusive lane, across the remaining traffic lane of Mission Street to the right turn lane. On Ninth Street, trolleys will have to merge across several congested lanes so that they can turn left across Market onto Hayes. On Seventh, trolleys will have to contend with traffic generated by the Main Post Office, Greyhound and Golden Gate Transit buses. Delays caused by these operations can be expected to cause backups onto Mission Street, leading to delays for Mission trolleys as well.

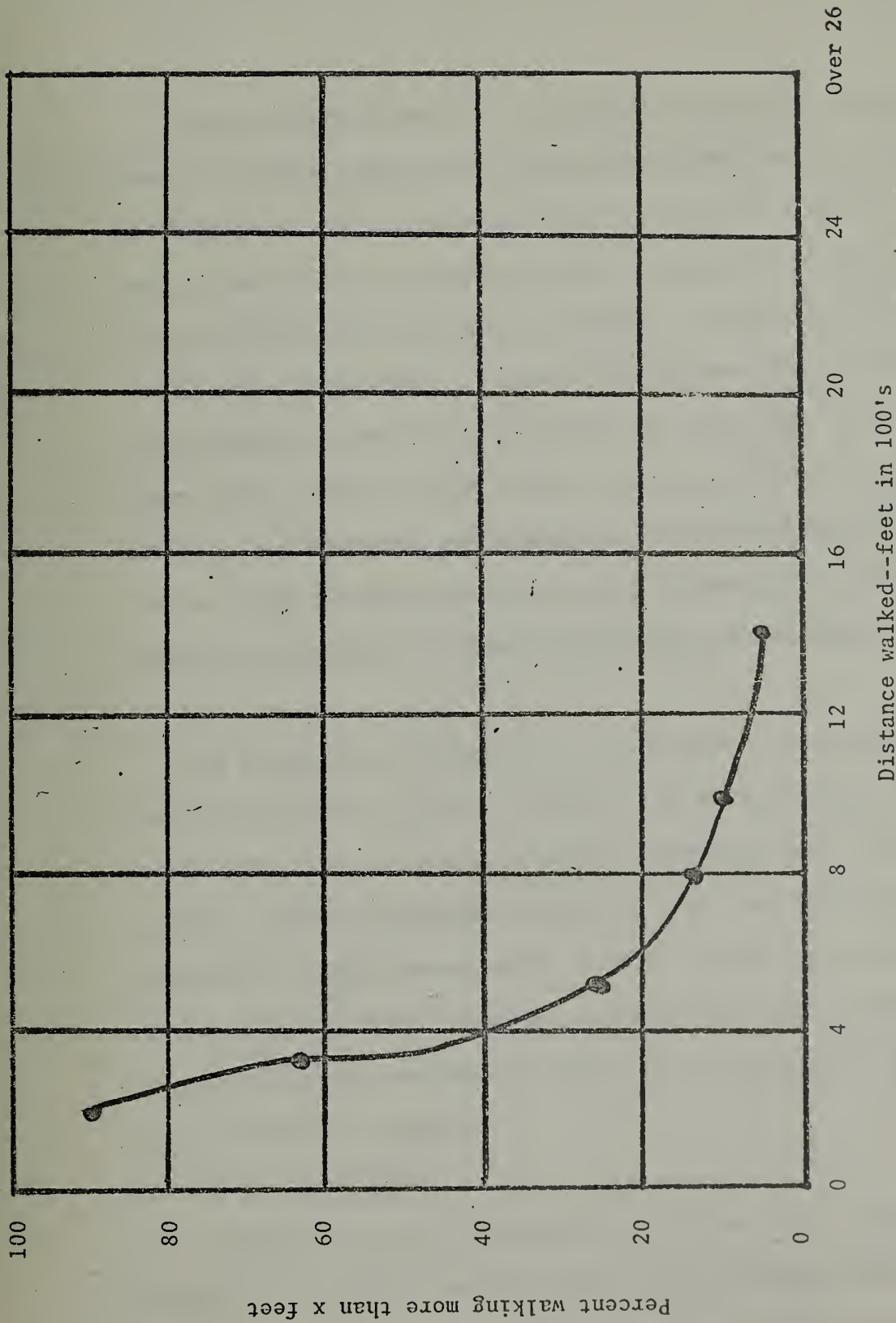
2.0 Service Impacts

2.1 Accessibility

a. A shift in the routing of a line causes a shift in the

"catchment area" of the line's passenger stops. The radius of a stop's principal catchment area is about 1000 feet; most of a line's patronage is gathered from a walking distance of about 1000 feet, and very few passengers are willing to walk more than a quarter mile, or about 1300 feet, to catch a bus. Figure 4 is a graph showing the decay in passenger attractiveness of surface transit with increasing distance from a stop.

Figure 4



Downtown Washington, D.C. distribution of people walking more than various distances to bus stops.

Source: Alan M. Voorhees and Associates, Feasibility of Transit Service for Columbia .
(Washington: By the author, 1964), Fig. II.

Market Street stops with a catchment area radius of 1000 feet do, in fact, serve most of the concentrated retail activity and employment north of Mission Street. However, a shift in trolley coach routes to Mission Street--a distance of 600 feet, or 60% of the radius of a stop's principal market area--will change this considerably. Figure 5 demonstrates that Alternative D will dramatically shift the principal catchment area of stops for lines 5, 6, 7 and 21 to the south. A large concentration of retail activity, entertainment and employment now located within 1000 feet of stops on these heavily patronized transit lines will be beyond the principal catchment area of these lines under Alternative D.

As demonstrated in Appendix I, most transit passengers going Downtown from the districts served by the Market Street trolley coach lines have destinations north of Market Street. This is particularly true of non-work trips which are often discretionary and represent a travel market which is quite responsive to changes in the quality of transit service. Alternative D would represent a significant deterioration in transit service provided to the destinations of most passengers.

2.2 Travel Time

Alternative D would increase travel time for all passengers on lines 5, 6, 7 and 21 who have trip origins or destinations north of Market Street. It would also increase travel time for passengers

on lines 6 and 7 who have trip origins or destinations south of Market Street since the route diversion to bring those lines to Mission Street plus the Mission delay is longer than the walking time from Market to Mission Street. Travel times would also be increased for passengers going to or coming from Downtown on Mission trolley lines 9, 12 and 14. This could be partially offset by reduced travel times for passengers using diesel bus lines 11-Hoffman and 26-Valencia, and having trip origins or destinations north of Market.

Figure 5

MISSION REROUTE



SHIFT IN 1000 FOOT CATCHMENT AREA



Area within 1000 feet of Market Street stops but not within 1000 feet of Mission Street stops.



Area within 1000 feet of Mission Street stops (outbound) but not within 1000 feet of Market Street stops



Common 1000 foot catchment area



2.3 Reliability

Reliability, which with travel time is one of the most important service qualities affecting passengers, will suffer under Alternative D. The operating difficulties identified in section 1.3, related basically to the capacity limits of transit operations on Mission Street, will exacerbate service problems on seven of MUNI's most heavily travelled routes, reducing their ability to attract and hold patronage.

3.0 Environmental Considerations

3.1 Noise

a. Alternative D will have a beneficial effect on Mission Street inasmuch as the noise due to diesel buses will be removed. Trolley coaches do make some noise, of course, but the increase in trolleys, though large, will not be enough to counter the drop in noise resulting from diversion of the present 32-38 inbound and outbound diesels in the rush hour.

b. Alternative D will have a very strong negative effect on lower Market Street in terms of noise pollution; the effect, however, will vary depending upon the point at which the diesel bus volumes are being measured.

From the Embarcadero to Fremont on Market Street there are presently 32 outbound diesel buses from 4:30 to 5:30 P.M., with a peak 20 minute flow rate of 42; on Mission there are 21 diesel

buses over the same segment, with a peak 20-minute rate of 37. Assuming discontinuance of the 14 Limiteds and Expresses and dieselization of the 8 line, the outbound rush hour total on Market east of Fremont would be 54 diesels with a peak 20-minute rate of 85. Inbound there would be 35 buses in the peak hour here, with a peak 20-minute rate of 36. Therefore, during the peak hour, this segment of Market from Fremont to the Ferry would be exposed to 89 diesel buses, with a peak-flow rate of 121. This would mean an average of one diesel bus every 40 seconds over a full hour, and every 30 seconds in the 4:50-5:10 P.M. peak twenty minutes.

Similarly, on Market between Fourth and Fifth, the total number of diesels, inbound and outbound, would be 101 from 4:30 to 5:30, on an average of every 36 seconds, with a peak 20-minute rate of 133 per hour or one bus every 27 seconds.

The worst situation would exist in the congested heart of Downtown Market Street between Fremont and Third, where the 38-Geary diesel bus volume would be added to those now on Market, the dieselized 8 line and the diesels diverted from Mission Street. This would produce a combined inbound and outbound volume on this stretch of Market of 140 diesel buses between 4:30 and 5:30 P.M., or an average of one every 26 seconds for a full hour; the twenty minute peak flow rate from 4:50 to 5:10 P.M., the time when the greatest number of people are exposed to environmental conditions

on Market Street, would equal 187 per hour, or one every 19 seconds on average.

c. Noise produced by diesel buses on the 38 Express, which runs for only one block on Market, and by diesel buses on lines crossing Market, is excluded from the above.

3.2 Air Pollution

a. Alternative D would have a modest positive effect on Mission Street's air pollution problem by removing 32-38 inbound and outbound diesel buses in the rush hour.

b. In return for the reduction in diesel bus emissions on Mission Street, that pollutant volume, plus that now being produced by Market Street diesel lines, plus the volume to be produced by dieselization of the heavy #8 line, would be found on beautified Market Street. Again, the pollution problem would vary by location on Market Street according to the bus volumes feeding into or branching off from the flow of traffic. Generally the highest volumes of diesel pollutants produced are a function of the quantity of service provided, which, in turn is a result of the concentrations of people in a travel market; unhappily this means that, with diesel bus service, high concentrations of people (both transit passengers and non-passengers alike) and nitric oxides usually coincide.

Overall, Alternative D would increase the weekday diesel bus

mileage operated on Market Street from 1,029.2 miles to 2,254.5, or by 119.1%. Based on the average per-vehicle-mile emission rates for 1973 determined by the Bay Area Air Pollution Control District, estimated weekday diesel bus pollutant production on Market Street would increase as follows:

<u>Pollutant</u>	<u>Present (Alternatives A, B)</u>	<u>Alternative D</u>
Particulates	1,543.8 grams	3,381.8 grams
Organics	1,749.6 grams	3,832.7 grams
NOx (Nitrogen Oxides)	53,518 grams	117,234 grams
SO ₂ (Sulfur Dioxide)	720.4 grams	1,578.2 grams
CO (Carbon Monoxide)	30,876 grams	67,635 grams

3.3. Visual Intrusion

- a. Alternative D would reduce the visual intrusion of transit on Market Street by removing the on-street overhead wires.
- b. Alternative D would not result in any substantial change in the visual environment of Mission Street.
- c. Alternative D would cause visual intrusion on some streets where wire would have to be installed:
 - on Octavia from Page to Grove
 - on Gough from Hayes to Haight
 - on Grove from Polk to Hyde
 - on Seventh from Mission to Market
- d. Alternative D would not reduce the visual intrusion of trolley coach wires crossing Market at:

--Main--Drumm and Davis--Beale
 --Third--Kearney and Stockton--Fourth
 --Hyde--Eighth and Ninth--Hayes
 --Van Ness Avenue
 --Church Street

c. Alternative D would install an additional overhead crossing of Market at Seventh Street, causing visual intrusion at that point.

3.4 Secondary Effects

The reduction in accessibility to and from major downtown activities, as noted in section 2.1, and the increase in travel time for transit patrons, noted in section 2.2, will make MUNI service less attractive overall. This may result in some drop in patronage on Mission and Market trolley coach lines; the extent of such a drop, should it occur at all, cannot be estimated now as we have little knowledge of the ridership characteristics of our lines. It is possible that such a drop could be made up for by a shift to more direct diesel routes, this requiring more diesel buses on other lines; it is also possible that there could be some small shift to automobile use.

More importantly, the drop in service quality occasioned by Alternative D will certainly diminish the opportunity to use MUNI as a tool to reduce downtown automobile usage. This, of course, would have important adverse environmental consequences. There

would be under this Alternative a much reduced opportunity to cut Downtown noise, air-pollution, transportation energy consumption, and to reduce the demand for downtown parking.

Alternative E: Reroute Trolley Coaches via Howard and Folsom Streets and Beale, Main, Davis, Drumm and Sacramento Streets to the Financial District (Figure 6)

Alternative E proposes that the 8-Market trolley coach line be dieselized, and that lines 5, 6, 7 and 21 no longer run down Market Street, but be rerouted as follows:

5-McAllister: Inbound as now via McAllister and Hyde, then across Market, south on Eighth, east on Folsom, north on Main, across Market, north on Drumm to Sacramento Street terminus; return west on Sacramento, south on Davis, across Market, south on Beale, west on Howard to Seventh; north on Seventh across Market, then on Seventh Street north to McAllister and outbound as at present.

6-Masonic and 7-Haight: Inbound as now via Haight, Laguna and Page, then diverting north on Octavia to Grove, east on Grove, across Market at Marshall Square, south on Eighth, east on Folsom, north on Main, across Market, north on Drumm to Sacramento Street terminus; return west on Sacramento, south on Davis, across Market, south on Beale, west on Howard to Ninth, north on Ninth, across Market to Hayes, west on Hayes, south on Gough to Haight, then west on Haight outbound as at present.

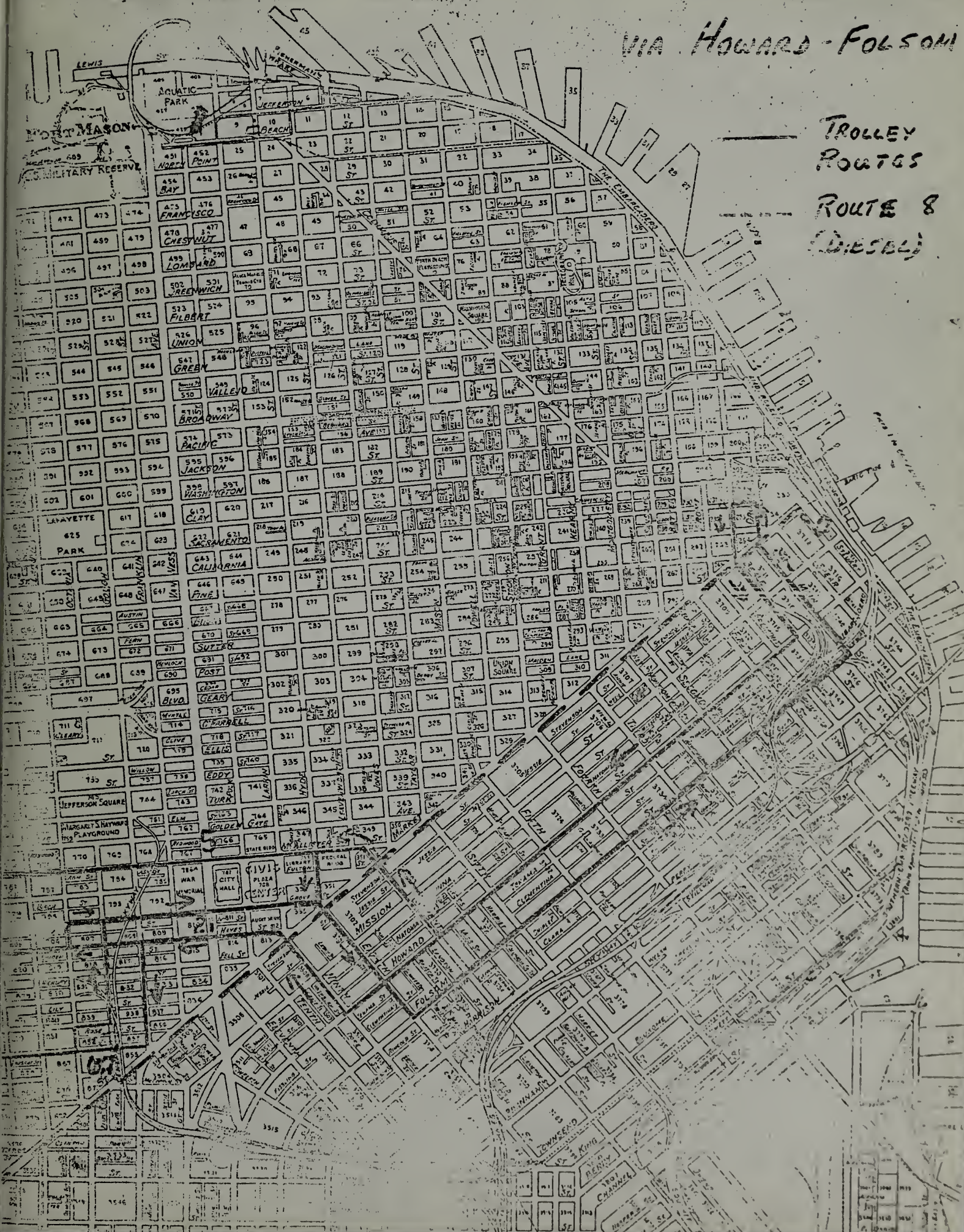
21-Hayes: Inbound as now via Hayes, Laguna and Grove, then continuing east on Grove to Marshall Square, across Market, south on Eighth, east on Folsom, north on Main, across Market, north on Drumm to Sacramento Street terminus; return west on Sacramento, south on Davis, across Market, south on Beale, west on Howard to Ninth, north on Ninth, across Market to Hayes, then outbound as at present.

Figure 6

HOWARD-FOLSOM

TROLLEY
ROUTES

ROUTE 8
(DIESEL)



1.0 Operations Impacts

Changes envisioned by Alternative E could affect the running time, and the capital and operating cost, of re-routed lines 5, 6, 7 and 21 and existing lines 33 and 41. Estimated evening rush-hour round-trip running times over the downtown segment of the routes, and comparisons with present running times, are as follows:

5-McAllister:

- | | | |
|---|------------------|-------------|
| a) Present: Eighth and Market to Ferry and
return to Jones and Market | ... | 54½ minutes |
| b) Alternative E: Eighth and Market via
Eighth, Folsom, Main,
Drumm to Sacramento | --15 3/4 minutes | |
| Recovery time | -- 3 minutes | |
| Sacramento/Drumm via
Sacramento, Davis, Beale,
Howard, Seventh to Market | --14 3/4 minutes | |
| Total | --33 ½ minutes | |
| c) Difference: 1 minute decrease | | |

6-Masonic and Haight:

- | | | |
|--|------------------|---------|
| a) Present: Haight and Laguna to Ferry
and return | --47 | minutes |
| b) Alternative E: Haight and Laguna to Eighth
and Market | -- 8 | minutes |
| Eighth and Market via Eighth,
Folsom, Main, Drumm to
Sacramento | --15 3/4 minutes | |
| Recovery time | -- 1 minute | |
| Sacramento/Drumm via Sacramento,
Davis, Beale, Howard, Ninth to
Market | --16 ½ minutes | |
| Ninth and Market to Haight and
Laguna | -- 7 minutes | |
| Total | --43 | minutes |
| c) Difference: 1 minute decrease | | |

21-Hayes:

a) Present: Van Ness and Grove/Hayes to Ferry and return	--43	minutes
b) Alternative E: Van Ness and Grove to Eighth and Market	--2 1/2	minutes
Eighth and Market via Eighth, Folsom, Main, Drumm to Sacramento	--15 3/4	minutes
Recovery time	-- 4	minutes
Sacramento, Davis, Beale, Howard, Ninth to Market	--16 1/4	minutes
Ninth and Market to Van Ness/Hayes	-- 2	minutes
	--2 1/2	minutes
c) Difference: 2 1/2 minute decrease		

None of these changes in running time are sufficient to require addition or permit the deletion of trolley coaches to maintain service at existing levels on these routes.

As figure 7 indicates, the reroute to Folsom and Howard Streets of these heavily-patronized trunk lines would move the catchment area of their stops 1800 feet south for inbound passengers and 1200 feet south for outbound passengers. In both cases, this would place existing stops served by lines 5, 6, 7 and 21 outside a 1000-foot catchment area limit; beyond this limit we can expect only a very small percentage of passengers to be attracted to transit service (Figure 4). Alternative E would therefore not really be serving destinations on Market Street between Civic Center and Beale, but would rather be exchanging direct service to those locations for

direct service to the south of Market. Regrettably, this would mean duplication of service (the marginal 41-Union/Howard line runs on Folsom and Howard) in an area which can be easily reached by transfer to any of several north-south lines. Furthermore, this area is not now very transit-oriented and would not produce a significant quantity of patronage for the re-routed lines.

It is difficult to precisely forecast passenger reaction to a Folsom/Howard rerouting. It has been estimated that about one-fourth of the passengers on board lines 5, 6, 7 and 21 at Van Ness Avenue are going to or coming from Civic Center; presumably these passengers would continue to patronize the trolley lines. The remaining three-fourths of the passengers would have several travel options:

1. they could walk from Civic Center to their destinations;
2. they could transfer to MUNI METRO;
3. they could remain on board the trolleys and walk long distances to and from the rerouted lines or transfer to north-south routes;
4. they could patronize a paralleling diesel bus route;
5. they could transfer to a Market Street surface line.

At least a few passengers would take advantage of each of these options, but since the public does respond to the quality of service provided, one can conclude that some of these options would be

used than others on the basis of the quality of service they offer to MUNI passengers.

As noted already, few passengers walk more than 1000 feet to and from a transit stop; because of this it is relatively certain that few passengers would use option 1 and walk from Civic Center to their destination east of Jones Street. Similarly, because of service deficiencies which would be experienced in attempting to transfer to or from MUNI METRO (probable crowding, poor subway/surface integration) it cannot be concluded that a very substantial proportion of the three-fourths of the passengers to or from the area east of Jones Street would transfer to MUNI METRO. These two options, however, are similar in that they impose no additional capital or operating costs on MUNI. Because of the similarity of this proposal to Alternative C (the turnback alternative), therefore, it is assumed here, as in that case, that one-third of the patronage east of Civic Center (or one-fourth that at Van Ness Avenue, which is to say the same thing) would either walk or manage to use MUNI METRO.

Option 3, of course, imposes no additional cost penalty on MUNI if Alternative E is implemented, but would not, as noted, be attractive to present users of the trolley lines because of the long intervening distance between new service stops and Market Street. Options 4 and 5, on the other hand, would impose new costs on the MUNI, but would

also be perceived by passengers as offering a better level of service. It will be assumed for the purposes of this analysis that half the passengers remaining after Civic Center passengers, walkers and MUNI METRO transferers have gotten off, would stay on board the trolley while half would divert or transfer to diesel routes. The combined cost effect of Options 4 and 5 is calculated on the assumption that one-fourth the present maximum Market Street surface capacity now offered by lines 5, 6, 7 and 21 together would have to be provided by diesel buses for those transferring or diverting to diesel routes.

Presently lines 5, 6, 7 and 21 offer a combined evening rush-hour outbound volume east of Jones Street of 58 trolleys, with a peak 20-minute rate of 75 per hour. The most economical way to provide a 25% equivalent capacity would be to run a Van Ness to Ferry shuttle service as a #8 turnback with a peak hour service rate of 14 1/2 vehicles per hour, or about a four-minute headway. Given a rush-hour round trip time of about 46 minutes including recovery time, some 11 additional diesel buses would be required.

1.1 Capital Costs

a. Dieselization of the 8-Market trolley coach line would require the purchase of more diesel buses. The Municipal Railway Schedule and Traffic Department's current "Recapitulation and Analysis

of Schedules" indicates that this line requires 20 trolleys for the evening service peak. Assuming a 10% requirement for spares, and assuming that diesel buses and trolley coaches have similar operating characteristics, then a total of 22 additional buses would be required to dieselize the 8-Market line.

As indicated, 11 additional diesel buses would also be needed to provide surface capacity on Market Street. This would mean a total of 33 required for Alternative E. Assuming a cost of \$60,000 per bus, this would mean an immediate capital expense of \$1,980,000.

Assuming a ten-year design life for a diesel bus, this fleet would have to be replaced for the second-half of the 20-year operating period. The net present cost of that replacement, assuming 6% inflation and a 6½% interest rate, would be \$1,897,892. The total net present capital cost for 33 diesel buses for a 20-year operating period, under the cited assumptions, would therefore be:

$$\$1,980,000 + \$1,888,981.78 = \$3,868,981.78.$$

b. Alternative E. would require some modification of overhead.

The estimated capital cost would be as follows:

16,200 feet of grooved trolley wire @ \$1.60 per foot	=	\$ 25,920.
5 selectric switches @ \$3,500 each	=	\$ 17,500.
6 trailing frogs @ \$1,800 each	=	\$ 10,800.
8 crossovers @ \$2,000 each	=	\$ 16,000.
64 poles with bracket assembly @ \$2,500 each	=	\$160,000.
15 poles @ \$2,000 each	=	\$ 30,000.
9 spans @ \$400 each	=	\$ 3,600.
		<hr/>
Material Subtotal	=	\$263,820.
Engineering (10%)		\$ 26,382.
Contingencies (10%)		\$ 26,382.
		<hr/>
TOTAL		\$316,584.

At 6½% interest, the annual payment over the 30-year assumed life of the overhead would be:

$$\$316,584 (.07658) = \$24,244.00272$$

The present value of these payments for a 20-year operating would be:

$$\$24,244.00272 (11.0185) = \$267,132.54$$

1.2 Operating Costs

a. As noted, Alternative E would require some 11 additional diesel buses to handle patrons diverted to through diesel routes or transferring to Market Street surface diesel lines. In terms of operating cost, however, diesels placed in service on competing through lines to handle diverted passengers to or from points west of Van Ness Avenue would permit a reduction of service on the trolley lines. The operating cost of some of the diesels would thus be offset by savings resulting from cutbacks in trolleys.

The greatest diversion would probably occur on the Haight lines, where trolleys on the 6-Masonic and 7-Haight share their routes with diesels on the 66-Quintara, 71-Haight-Noriega and 72-Haight-Sunset lines. Assuming a 20% diversion, then the 24 peak hour trolleys could be reduced by 5. Some patrons on the 5-McAllister line would walk two blocks north to the 31-Balboa; a 15% diversion from the current 20 trolleys would reduce requirements by 3. The 21-Hayes is more isolated, and there would be relatively little diversion there--perhaps a single trolley might be saved.

On this basis, the addition to service of 11 diesels would be offset by the saving of 9 trolleys, so that the added operating cost would be for only two vehicles. Based on the assumptions used

in this analysis this cost is estimated at 2 (\$860.967) = \$1,721,934 for a 20-year operating period (see Appendix D).

1.3 Recapitulation of Estimated Added Costs

The estimated total added cost of Alternative E in present dollars for a 20-year operating period, assuming 6% inflation, 6½% interest, a 20-year design life for trolley coaches and a ten-year design life for diesel buses, is:

1.1 Capital:	35 diesel buses for 20 years:	\$3,868,981.78
	Overhead modification :	\$ 267,132.54
1.2 Operating:	2 extra vehicles for 20 years:	\$1,721,934.
	TOTAL	\$5,858,048.32
	USE	\$5,900,000.

1.4 Schedule Adherence

a. Folsom and Howard are one-way streets through what are now marginal activity areas. Under present conditions no additional problems in schedule adherence on those streets is foreseen, although this may change with development on the Yerba Buena site.

b. A major problem of Alternative E is the proposed routing via Drumm, Sacramento and Davis Streets. This is in the congested Financial District adjacent to the Embarcadero Center; it also overlaps part of the 41-Union/Howard trolley

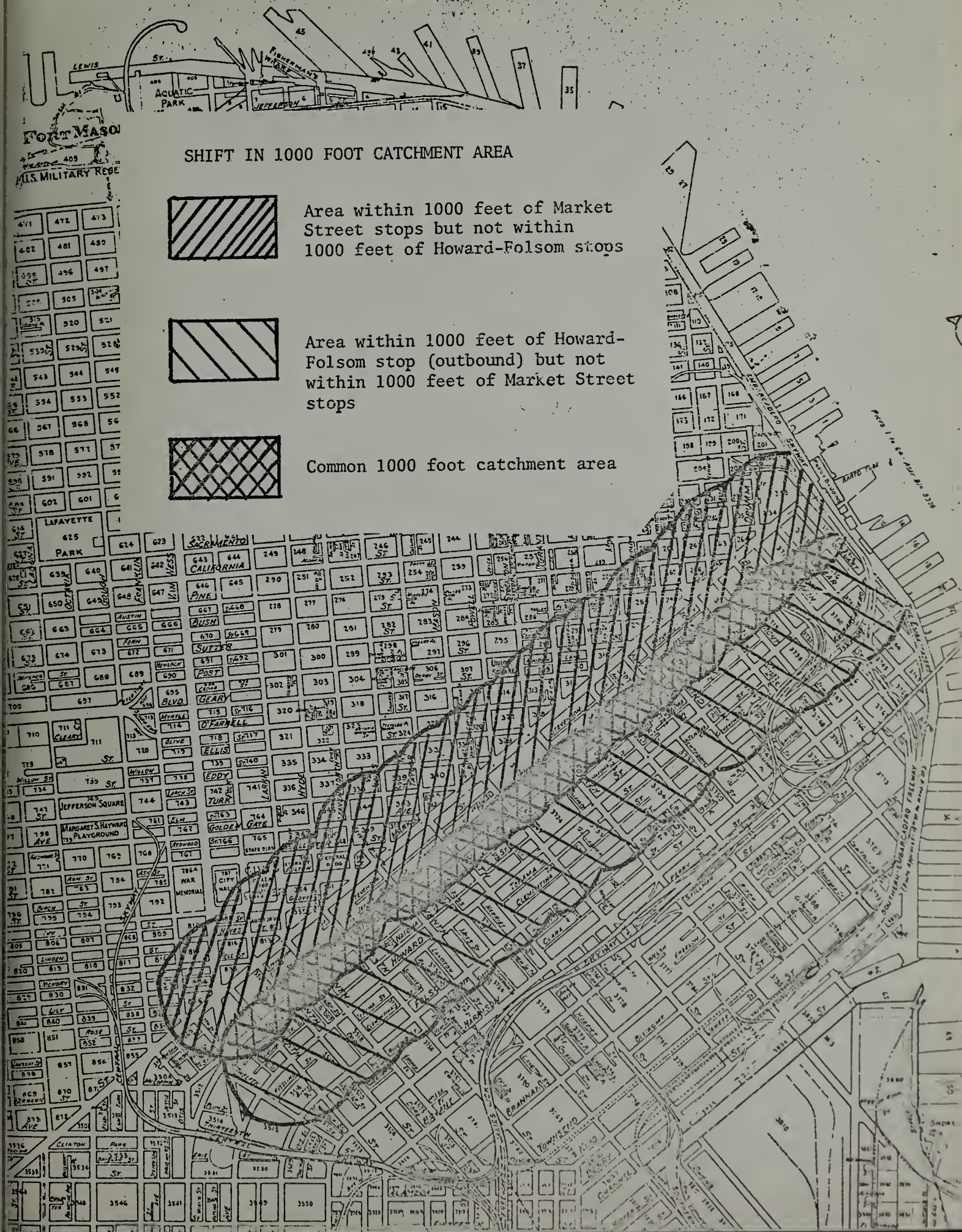
coach line than is more intensively operated than the south of Market section. Accordingly, the transit vehicle volumes on narrow Main-Drum, Sacramento and Davis-Beale Streets will be very high. In the evening rush hour, Davis/Beale Streets will have about 77 trolley coaches with a peak 20-minute rate of 102; this would mean an average headway of 47 seconds with a peak headway of 35 seconds. This volume of vehicles would be very difficult to handle; headways this short are naturally prone to unreliability, especially under circumstances as congested as these. On Sacramento Street the diesel buses of the 55 line would add to the flow, giving a total evening rush hour volume of 107 and a peak 20-minute rate of 138 vehicles per hour--barely operable volumes. There would be the added problem of a terminal point which would avoid disrupting the 41 and 55 lines. It would probably be necessary to dispense with recovery time downtown; this would eliminate some of the "slack" which is useful in getting vehicles back on schedule. There is the final consideration that further development of Embarcadero Center would aggravate these problems.

2.0 Service Impacts

2.1 Accessibility

Alternative E would negatively affect passenger accessibility to all important downtown jobs, commercial and entertainment opportunities now served by lines 5, 6, 7 and 21.

Figure 7



a) The shift in the catchment area of stops served by these lines will effectively remove them from any direct access role to the majority of downtown trip destinations. An added transfer to MUNI METRO, a Market surface line or a north-south route will be interposed between passengers now using these lines and their destinations. In exchange for the direct access to the principal concentrations of transit trip destinations north of Market Street, an increased area of the South of Market will be brought within the catchment area of lines 5, 6, 7 and 21. However, as noted in Appendix I, only 13.4% of home-to-work transit trips and about 5% of other transit trips from the areas served by lines 5, 6, 7, 8 and 21 are destined to the area south of Howard Street. This suggests that Alternative E will result in a considerable inconvenience to the majority of passengers on these lines in exchange for improved access for a small minority of passengers.

b) Alternative E does maintain service to the Financial District; however, the proposed route is sufficiently circuitous that it would serve as a major discouragement to through travel. Passengers would find that they could save time in reaching the financial district by transferring to MUNI METRO at Civic Center. Outbound, however, they would face an awkward transfer from MUNI METRO to lines 6, 7 and 21 (requiring a walk from the subway platform to the surface at Marshall Square, from Eighth to Ninth, across Larkin and up Hayes to the stop behind Civic Auditorium).

c) Access to regional transit connections will be affected by Alternative E. Connections to AC Transit at the East Bay Terminal will remain basically the same, requiring a walk of several hundred feet.. Similarly, connections will still be made with Golden Gate Transit bus lines. Service to the SP Peninsula service would be largely unaffected. Connections to BART will still be made, but not as conveniently as at present. In place of the direct access to and from all Market Street BART stations, good access would be provided only eastbound to Civic Center Station and to and from Embarcadero station; the latter, however, could only be reached via the South of Market detour.

The ability of lines 5, 6, 7 and 21 to serve as feeders to and from the increased Golden Gate Ferry service would be greatly diminished.

2.2 Travel Time

Passenger travel time will vary for passengers with the location of their downtown trip origin or destination and the mode used for the downtown portion of their journey.

a) Travel times to and from Civic Center will not be affected by Alternative E, provided that diminished patronage on the trolley coach lines does not lead to a cutback in frequency of service.

b) To the retail and commercial core of Market Street between Fourth and Fifth Streets, rush hour travel times for patrons of lines 5, 6, 7 and 21 by all options will be longer under Alternative E than they are now with Market Street trolley coach operation (except for the MUNI METRO transfer option, which equals the existing travel time to the basement level of stores with entrances onto the Powell Street Station concourse). Trips by the diesel bus surface transfer option or by a MUNI METRO transfer would both take longer than present all-trolley trips, but would be shorter than using the Folsom/Howard trolley route and then walking or transferring.

In the off-peak period, the margin in favor of trolley coach surface operation increases.

c) For Financial District destinations, a transfer to MUNI METRO would result in a markedly faster journey than a trolley coach trip via Folsom or Howard Streets. This should result in a diversion of many Financial District passengers from the trolley lines to MUNI METRO; in fact, it is hard to justify operating lines 5, 6, 7 and 21

lines to the Financial District by so devious a routing, except perhaps as a poor supplementary service to relieve overcrowding on MUNI METRO.

2.3 Reliability

The operation of trolley coaches under Alternative E should be reasonably reliable, provided the congestion problem in the Financial District can be overcome. In fact, reliability is the sole virtue of this proposal, a virtue largely negated by the lack of passengers to benefit from it.

3.0 Environmental Considerations

Any reduction of trolley coach operation on Market Street would result in an increase, however slight, in diesel bus operation there. This would affect the noise pollution, visual character and air pollution of the street.

3.1 Noise

Stop-and-go Downtown traffic leads to the requirement of frequent acceleration and deceleration. With diesel buses, each acceleration in turn involves a "winding out" of the motor to a high number of revolutions per minute. This produces a noise peak. As the number of diesel buses producing this noise increases on Market Street, the overall noisiness of the street increases.

Alternative E would increase the volume of diesel buses on Market Street. The total diesel volume would vary, depending on the point at

which it was measured. Estimated evening rush hour diesel bus volumes on various segments of Market Street would be as follows under Alternative E:

--From the Ferry to Fremont Street

INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing 12	15	32	42	44	57	82	63
+Dieselized #8 16	12	18	24	34	36		
+ #8 Turnback 15	15	15	15	30	30		
Total Alt. E 43	42	65	81	108	123	33	29

--From Fourth to Fifth

INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing 18	21	32	42	50	63	72	57
+Dieselized #8 16	12	18	24	34	36		
+ #8 Turnback 15	15	15	15	30	30		
Total Alt. E 49	48	65	81	114	129	32	28

--From Fremont to Third

INBOUND		OUTBOUND		TOTAL		OVERALL AVERAGE FREQUENCY (IN SECONDS)	
4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *	4:30-5:30	Peak 20-Min. Rate *
Existing 32	36	63	87	95	123	38	29
+Dieselized #8 16	12	13	24	34	56		
+ #8 Turnback 15	15	15	13	30	30		
Total Alt. E 63	63	96	126	159	189	23	19

* Expressed hourly

As the charts indicate, Alternative E would produce a heavy flow of diesel buses--and resulting frequent production of noise peaks--over most of beautified Lower Market Street.

Alternative E would more than double rush hour diesel bus noise production at the lower end of Market Street as overall frequencies would increase from one diesel bus every 82 seconds to one every 33 seconds, on average. The increase would be similar in the retail core of Market between Fourth and Fifth streets, as diesel bus frequencies would increase from one every 72 seconds to one every 32 seconds, on average. From Fremont to Third the increase would be proportionately lower, but the resulting noise problem would be the worst with a diesel bus passing every 23 seconds on average for a full hour.

These figures do not reflect noise produced by diesel buses crossing Market Street, such as those on the 15-Third and Kearney, 42-Third and Evans and 30-Stockton Express lines.

3.2 Air Pollution

Alternative E would increase MUNI's reliance on diesel propulsion in the downtown area. Overall, weekday diesel bus mileage operated on Market Street would grow from 1,029.2 miles to 2,320.8 miles, or 125.5%. Based on the average per-vehicle-mile emission rates for 1973 determined by the Bay Area Air Pollution Control

District, estimated weekday diesel bus pollutant production on Market Street would increase as follows:

<u>Pollutant</u>	<u>Present (Alternatives A, B)</u>	<u>Alternative E</u>
Particulates	1,543.8 grams	3,381.8 grams
Organics	1,749.6 grams	3,945.4 grams
NOx (Nitrogen Oxides)	53,518.0 grams	120,682.0 grams
SO ₂ (Sulfur Dioxide)	720.4 grams	1,624.6 grams
CO (Carbon Monoxide)	30,876.0 grams	69,624.0 grams

3.3 Visual Intrusion

a) Alternative E would reduce the visual impact of transit on Market Street by removing the on-street overhead wires.

b) Alternative E would not result in any substantial change in the visual environment of Folsom or Howard Streets.

c) Alternative E would cause visual intrusion on some streets where trolley wire would have to be installed:

- on Octavia from Page to Grove
- on Gough from Hayes to Haight
- on Grove from Polk to Hyde
- on Seventh from Howard to Market
- on Eighth from Mission to Folsom
- on Ninth from Howard to Mission

d) Alternative E would not reduce the visual intrusion of trolley coach wires crossing Market at:

- Main-Drumm and Davis-Beale
- Third-Kearny and Stockton-Fourth
- Hyde-Eighth and Ninth-Hayes
- Van Ness Avenue
- Church Street

e) Alternative E would install an additional overhead crossing of Market at Seventh Street, causing visual intrusion at that point.

3.4 Second-Order Effects

Alternative E would reduce the capacity of lines 5, 6, 7 and 21 to perform a useful function within the Municipal Railway system. The loss of direct access to Downtown jobs, shopping and recreation would permanently handicap lines 5, 6, 7 and 21, and diminish MUNI's potential to serve as a vigorous competition to the automobile. This, in turn, would reduce the City's chances to reduce downtown noise and air pollution, transportation energy requirements and parking space demand.

Alternative F: Reroute Trolley Coaches Via Post and Sutter Streets
(Figure 8)

Alternative F proposes that the 8-Market trolley coach line be dieselized, and that lines 5, 6, 7 and 21 no longer run down Market Street, but be rerouted as follows:

5-Mc-Allister: Inbound as now via McAllister, then north on Van Ness to Post, east on Post, north on Kearny, east on Bush, south on Sansome to Sutter; returning west on Sutter, south on Van Ness, west on McAllister outbound as at present.

6-Masonic and 7-Haight: Inbound as now via Haight, Laguna and Page, then diverting north on Octavia, east on Grove, north on Van Ness, east on Post, north on Kearny, east on Bush, south on Sansome to Sutter; returning west on Sutter, south on Van Ness, west on Hayes, south on Gough, then west on Haight outbound as at present.

21-Hayes: Inbound as now via Hayes, Laguna and Grove, then diverting north on Van Ness, east on Post, north on Kearny, east on Bush, south on Sansome to Sutter; return west on Sutter, south on Van Ness, west on Hayes outbound as at present.

1.0 Operations Impacts

Changes envisioned by Alternative F for operation of lines 5, 6, 7 and 21 will affect their round trip running time, and hence

capital and operating costs in several ways: there will be a change in the length of the line; there is a difference in operating speed between Market and Sutter Streets; the addition of lines 5, 6, 7 and 21 will increase the peak hour flow of buses on Sutter and Post by about 70%, causing a congestion delay for all buses using those streets.

Figure 8

REROUTE VIA POST-SUTTER

TROLLEY
COACH

Route 8
(DIESEL)



Estimated evening rush hour round-trips running times over the Downtown segment of the routes, and comparisons with existing running times, are as follows:

5-McAllister

a) Present:	Van Ness and McAllister to Ferry and return.	41 minutes
b) Alternative F:	Post/Sutter and Van Ness to Sansome and return	29 minutes
	Van Ness and McAllister to Van Ness and Post/Sutter (round trip)	9 minutes
	Estimated congestion delay: Post/Sutter	<u>4 minutes</u>
	TOTAL:	42 minutes
c) Difference:		1 minute increase

6-Masonic and 7-Haight

a) Present:	Haight and Laguna to Ferry and return	46 minutes
b) Alternative F:	Haight and Laguna to Van Ness and Grove/Hayes (round trip)	9 minutes
	Van Ness and Grove/Hayes to Van Ness and Post/Sutter (round trip)	11 minutes
	Post/Sutter and Van Ness to Sansome and return	29 minutes
	Estimated congestion delay: Post/Sutter	<u>4 minutes</u>
	TOTAL:	53 minutes
c) Difference:		7 minute increase

21-Hayes

a) Present: Van Ness and Grove/Hayes to Ferry and return	43 minutes
b) Alternative F: Van Ness and Grove/Hayes to Van Ness and Post/Sutter (round trip)	11 minutes
Post/Sutter and Van Ness to Sansome and return	29 minutes
Estimated congestion delay: Post/Sutter	<u>4 minutes</u>
TOTAL:	44 minutes
c) Difference:	1 minute increase

1-California, 2-Clement, 3-Jackson, 45-Van Ness

All of these lines, plus turnback line 4-Sutter, operate on Sutter and Post Streets between Sansome Street and Van Ness Avenue; these lines would have an additional 4 minutes round trip running time added to their schedules due to the 70% increase in transit vehicles using those streets.

We will neglect, for the purpose of this section of the analysis, any increase in running time which would be experienced as a result of Alternative F by the following lines:

--on Sutter and Post Streets: lines 15-Third and Kearny, 19-Polk, 30-Stockton, 30-Stockton Express, 38-Geary Express;

--on Van Ness Avenue: line 47-Potrero.

ESTIMATED INCREASE IN VEHICLE REQUIREMENTS FOR ALTERNATIVE F

(Excluding passenger diversion to diesel routes)

A LINE	B INCREASE IN ROUND- TRIP RUNNING TIME IN MINUTES	C AVERAGE EVENING* HEADWAY	D ADDITIONAL VEHICLES	
			E MOTORLEY	F DIESEL BUS
5-McAllister	1	3		
6-Masonic	7	4	2	
7-Haight	7	6	1	
21-Hayes	1	5		
1-California	4	3	1	
2-Clement	4	2½		
3-Jacksch	4	5½	1	2
45-Van Ness	4	5		1
Existing Post/ Sutter lines				
			5	3
		TOTAL		

F-5

from "Recapitulation and Analysis of Schedules"
January 20, 1975

The lines most affected by the rerouting are the 6-Masonic and 7-Haight. Coincidentally, these lines are duplicated for the most part by diesel lines 66-Quintara, 71-Haight-Noriega and 72-Haight-Sunset, which would not have to be rerouted and could continue to run directly down Market Street. As an estimated $3/4$ of the patronage of lines 6 and 7 is to and from points east of Civic Center on Market, a large proportion of passengers using those lines may be expected to switch to the diesel lines that continue to offer direct service down Market Street. While it is difficult to determine the extent of this diversion, it can be assumed conservatively that at least 20% of the passengers on lines 6 and 7 would switch to lines 66, 71 and 72 under Alternative F. This would mean a saving in the number of trolleys operated and an increase in the number of diesel buses operated. In the evening peak hour there is a combined volume of 24 trolleys on lines 6 and 7, with a peak 20-minute rate of 27. A 20% patronage diversion would reduce this requirement by perhaps five trolleys, with a five diesel bus increase on the paralleling diesel lines. We will assume that the additional peak 20-minute rate would be six diesels per hour on the paralleling diesel lines.

1.1 Capital Costs

a) The five additional trolley coaches required due to the increase in running time would be counterbalanced by the saving in five due to diversion to diesel lines. In any event, dieselization of the

#8 line would make trolley coaches available. There is therefore no capital cost for trolley coaches for Alternative F.

b) Three additional diesel buses would have to be purchased to maintain service levels on the Sutter lines, 22 for the dieselization of the #8 line, and five to handle passengers diverted from lines 6 and 7--a total of 30. The immediate capital cost, assuming a conservative \$60,000. per bus, would be \$1,800,000; the net present replacement cost required to complete a 20-year operating period, based on a ten-year diesel bus design life, 6% inflation and 6½% interest would be \$1,717,000. The total net present capital cost of diesel buses for Alternative F would therefore be:

\$1,800,000.00
+ <u>1,717,256.17</u>
\$3,517,256.17

c) Alternative F would require some modification of overhead.

The estimated requirements would be as follows:

6500 feet of grooved trolley wire	
@ \$1.60 per foot	= \$10,400.
4 selectric switches @ \$3,500 each	= 14,000.
4 trailing frogs @ \$1,800 each	= 7,200.
2 crossovers @ \$2,000 each	= 4,000.
32 poles with bracket assembly	
@ \$2,500 each	= <u>80,000.</u>
Material Subtotal	= \$115,600.
Engineering (10%)	= 11,560.
Contingencies (10%)	= <u>11,560.</u>

TOTAL = \$138,720

At 6½% interest, the annual payment over the 30-year assumed life of the overhead would be:

$$\$138,720 (.07658) = \$10,623.1776 .$$

The present value of these payments for a 20-year operating period would be:

$$\$10,623.1776 (11.0185) = \$117,051.48.$$

d) Because of the relative decline in service offered by lines 5 and 21 under Alternative F, there would probably be some diversion of passengers to paralleling through diesel lines; this would lead to a capital requirement for additional buses on those lines. Because of the difficulty of estimating the extent of this diversion, this capital cost is omitted from the analysis.

1.2 Operating Costs

a) As indicated, eight additional vehicles will be required to maintain existing schedules on the existing Post/Sutter and rerouted lines. Placing these in service would impose a net present cost of 8 (\$860,967) = \$6,887,736 on the Railway over a 20-year operating period, based on the assumptions used in this analysis. (See Appendix D.)

1.3 Recapitulation of Estimated Added Costs of Alternative F

The estimated total added cost of Alternative F for a 20-year operating period, assuming 6% inflation, 6½% interest, a 20-year design life for trolley coaches and a ten year design life for diesel buses is:

1.1 Capital:	25 diesel buses for 20 years	\$ 3,517,256.17
	Overhead modification	<u>117,051.48</u>
	Subtotal Capital	\$ 3,634,307.65
1.2 Operating:	8 extra vehicles for 20 years	<u>\$ 6,887,736.00</u>
	TOTAL:	\$10,522,043.65
	USE:	\$10,600,000.00

1.4. Schedule Adherence

a) The 90% increase in rush-hour transit vehicles trying to use Sutter and Post Streets would, as noted, cause congestion that would, in turn, increase round-trip running time east of Van Ness Avenue by an estimated four minutes.

However, the impact on Muni would not be limited to slower service; operating such a large number of buses and trolley coaches would also strongly and negatively affect the ability to keep vehicles on schedule.

Based on maintaining present passenger capacities, the evening rush-hour diesel bus and trolley coach volume over most of Sutter Street from Sacramento, Van Ness would be as follows:

4:50 - 5:10 Rate

4:30 - 5:30 P.M.

(Expressed Hourly)

Existing Lines	Trolleys	Diesels	Total	Trolleys	Diesels	Total
1-California	12		12	12		12
2-Clement		14	14		13	18
3-Jackson	12		12	15		15
4-Sutter	8		8	12		12
45-Van Ness		12	12		12	12
TOTAL EXISTING	32	26	58	39	30	69

Re-routed Lines

5-McAllister	20		20	30		30
6-Masonic*	12		12	12		12
7-Haight*	7		7	9		9
21-Hayes	14		14	18		18

TOTAL, RE-ROUTED

69

69

GRAND TOTAL

108

138

Average Headway

32 seconds

26 seconds

* Assuming 5 bus diversion from lines 6 and 7 to lines 66, 71, 72

As the chart shows, the number of transit vehicles using Sutter Street from 4:30 to 5:30 p.m. would increase by 90%, while the rate in the peak 20-minute period would double. Inasmuch as it is difficult with the existing volumes to maintain scheduled service on Sutter and Posts, a serious deterioration in reliability could be expected with the imposition of lines 5, 6, 7 and 21 according to Alternative F. Certainly any gain which might have resulted from the minimal transit priority measures on these streets would be completely lost.

However, the operating situation would, in fact, be even worse over the most congested 2-block segment of Sutter from Kearny to Stockton, where the 30-Stockton trolley coach line and the 30-Stockton Express diesel bus line share the street with the Sutter/Post lines. The evening rush hour volumes here would be as follows:

	4:30-5:30 P.M.	Average Headway	4:50-5:10 P.M. Rate (Expressed Hourly)	Average Headway
Existing Sutter/Post Lines	58		69	
30-Stockton Trolleycoach	22		27	
30-Stockton Express	<u>13</u>		<u>18</u>	
TOTAL PRESENT VOLUME	93	39 Sec.	114	32 seconds
Rerouted lines 5, 6, 7 and 21 (assuming partial diversion to diesel routes)	<u>53</u>		<u>69</u>	
ALT. F- GRAND TOTAL VOLUME	146	25 Sec.	183	20 seconds

These transit vehicle volumes, required by Alternative F, are inoperable on Sutter Street. Even the present situation, as passengers of the Stockton trolley line are aware, begs for relief.

Adding large numbers of trolleys to Sutter would greatly compound the present problem and lead to chaotic operations. As the Sutter/Post lines loop via Kearny and Bush Streets, these difficulties could be counted on to "spill over" onto the heavily used Third and Kearny (routes 15 and 42) service.

b. The attempt to reroute trolley coaches via Van Ness Avenue in order to gain the Sutter/Post pair would run afoul of the heavy Golden Gate Bridge bus, truck and auto traffic. This would further affect service reliability, and probably have unfortunate consequences for Golden Gate Transit's Civic Center service as well. While volumes would not be as high as those on Sutter Street, operating 85 trolleys and diesel buses in the rush hour and a peak 20-minute rate of 102 (36 second average headway) will be extremely difficult on Van Ness Avenue; service would naturally be unstable and prone to unreliability.

2.0 Service Impacts

2.1 Accessibility

Alternative F would negatively affect passenger accessibility to many Downtown jobs, commercial and recreational opportunities now served directly by lines 5, 6, 7 and 21.

a. Alternative F would maintain through service to the retail and entertainment district north of Market Street, albeit by a circuitous routing.

b. Direct service by lines 5, 6, 7 and 21 to jobs and retail activities along Market Street between Fifth Street and Van Ness Avenue would be lost. In fact, except for outbound service on lines 6 and 7, it would not even be possible for passengers on the rerouted lines to transfer to or from a Market Street line serving the area between Fifth and Van Ness; the best inbound passengers could hope for would be to squeeze onto the 31-Balboa at its maximum load point, Van Ness and Eddy, in order to reach Market Street at Mason. (A significant amount of transferring on this pattern would, of course, lead to increased requirements for diesel buses on the 31 line.) This reduction in direct transit service would make more difficult the commercial rejuvenation envisioned for this section of Market Street.

c. An estimated $\frac{1}{4}$ of the passengers on lines 5, 6, 7 and 21 are travelling to or from Civic Center. Alternative F would continue to offer direct service to this destination; however, the eastern part of Civic Center, in the vicinity of the Library, the Department of City Planning and the old Federal Building, would be 1000 feet or more from the nearest Van Ness Avenue stop. To many passengers using these lines to Civic Center, this would be an increase in the access distance to transit service.

d. Access to regional transportation systems would be worsened

by Alternative F. Even though lines 5, 6, 7 and 21 would "serve" Civic Center, the nearest stop to a Civic Center BART station entrance would require a quarter mile walk; to this would have to be added the walking distance from the station entrance through the mezzanine to the platform. Such a distance would be a considerable discouragement to combined MUNI/BART riding, especially by comparison with the present routing which delivers passengers directly to any of several station entrances. Montgomery station could be used only at the penalty of a long ride via Van Ness and Sutter/Post Streets.

Similarly the transfer distance to the East Bay Terminal from the nearest stop on the rerouted lines--Sutter and Sansome--would be about 500 feet greater than that from the nearest stop now served on Market Street; and, again, the Sutter and Sansome stop could only be reached by a tediously indirect ride via Van Ness, Post and the Kearny-Bush-Sansome loop.

Direct connections with the Golden Gate Ferry, now reached via the routing up Market Street, would be lost just as the Ferry's importance as a regional transit service is to be increased. Access to Southern Pacific Peninsula Service would require a transfer as it does now, but overall journey time to the SP Depot would be longer since the transfer point, Sutter and Stockton, is farther from the Depot and could only be reached by a circuitous ride. Service

to the Greyhound Depot is now virtually direct; Alternative F will interpose a walk of about a half mile.

2.2 Travel Time

a. In general, overall travel time to and from Civic Center would not change under Alternative F, though there would be an increase for destinations on the east side of Larkin Street.

b. In the retail core of Downtown, in the vicinity of Stockton Street, the passenger walking distance to and from transit stops served by lines 5, 6, 7 and 21 would not differ significantly from what it is now. However, overall travel time by transit to Downtown shopping and retail employment would increase because of the indirect transit routing of Alternative F, and because of the low speeds attainable under congested conditions on Post and Sutter Streets. Market Street shopping would be more than 1000 feet from a #5, 6, 7 or 21 stop; this is beyond the distance most passengers will walk. (See Figure 4.)

c. Superficially, the Alternative F routing appears to serve the Financial District. In fact, travel times to and from Financial District points will be increased by Alternative F. Increases in travel time are as follows:

Estimated Evening Rush-Hour Travel Time (in minutes)
From California and Montgomery Streets.

--via #5-Mc-Allister to McAllister and Van Ness

	<u>PRESENT</u>	<u>ALTERNATIVE F</u>	<u>INCREASE</u>
Walk time*	6	4	
Wait time ($1\frac{1}{2}$ headway)	$1\frac{1}{2}$	$1\frac{1}{2}$	
In vehicle time	<u>$13\frac{1}{2}$</u>	<u>19</u>	
TOTAL:	21	$24\frac{1}{2}$	$3\frac{1}{2}$

--via #6-Masonic or #7-Haight to Haight and Fillmore

	<u>PRESENT</u>	<u>ALTERNATIVE F</u>	<u>INCREASE</u>
Walk time*	6	4	
Wait time ($\frac{1}{2}$ headway)	$2\frac{1}{2}$	$2\frac{1}{2}$	
In vehicle time	<u>20</u>	<u>27</u>	
TOTAL:	$28\frac{1}{2}$	$33\frac{1}{2}$	5

--via 21-Hayes to Hayes and Van Ness

	<u>PRESENT</u>	<u>ALTERNATIVE F</u>	<u>INCREASE</u>
Walk time*	6	4	
Wait time ($\frac{1}{2}$ headway)	$2\frac{1}{2}$	$2\frac{1}{2}$	
In vehicle time	<u>$14\frac{1}{2}$</u>	<u>$20\frac{1}{2}$</u>	
TOTAL:	$22\frac{1}{2}$	27	$4\frac{1}{2}$

* Assumed walking speed 3 mph.

d. Accessibility to and from points on Sutter and Post Streets between Powell Street and Van Ness Avenue would be slightly improved by the Alternative F no-transfer service. This advantage would be partly offset by the increased running time on Sutter and Post and the general unreliability of service there, both resulting from the large transit volumes imposed by Alternative F. Inasmuch as this market is small, relative to that now served by lines 5, 6, 7 and 21, the gain in accessibility would be unimportant compared to the loss suffered by diversion from Market Street.

e. In general, the Alternative F rerouting would result in poorer service to the transit patron, purchased at greater expense of vehicles and time, and in further duplication of routes. It would contravene the basic notion in route design, embodied in the Plan for Transportation element of the City's comprehensive Plan, that, "Routes should, to the extent possible, run in straight lines between well-known termini." (p. 17.) Routes which go around two sides of a right triangle, rather than using the "hypotenuse"--Market Street, have long been discredited.

2.3 Reliability

As indicated in the discussion of schedule adherence under this Alternative, operation of transit vehicles on the very short headways proposed would be very unstable. There is every likelihood that bunching would be a frequent and regular occurrence, with resulting service gaps and alternate jammed and empty vehicles--an ex-

tremely ineffective and inefficient use of equipment. Passengers would perceive this, and rightly, as poor and unreliable service.

3.0 Environmental Considerations

3.1 Noise

a. The increase in the number of trolleys using Sutter and Post would not cause any large increase in noise levels on those streets.

b. Diversion of passengers to through diesel routes on Market Street could result in a significant increase in noise pollution there. A minimum of five additional rush-hour diesels on Market due to diversion from the Haight Street trolleys to Sunset diesels 66, 71 and 72 has been identified.

c. Dieselization of the #8 line would add to noise pollution on both Upper and Lower Market. The estimated minimum total diesel bus volumes in the evening rush-hour on various segments of Market Street are as follows:

- From the Ferry to Fremont Street

	<u>INBOUND</u>		<u>OUTBOUND</u>		<u>TOTAL</u>	<u>OVERALL AVE. FREQUENCY</u> (IN SECONDS)	
	4:30- 5:30	PEAK- 20 MIN. RATE	4:30- 5:30	PEAK- 20 MIN. RATE		4:30- 5:30	PEAK - 20 MIN. RATE
Existing	12	15	32	42	44	82	63
+ Dieselized #8	16	12	18	24	34		
+ Minimum Diversion to Diesels	2	3	5	6	7		1
TOTAL ALT. F	30	30	55	72	85	42	35

- From Fourth to Fifth

	<u>INBOUND</u>		<u>OUTBOUND</u>		<u>TOTAL</u>	<u>OVERALL AVE. FREQUENCY</u> (IN SECONDS)	
	4:30- 5:30	PEAK- 20 MIN. RATE	4:30- 5:30	PEAK - 20 MIN. RATE		4:30 - 5:30	PEAK- 20 MIN.
Existing	18	21	32	42	50	72	57
+ Dieselized #8	16	12	18	24	34		
+ Minimum Diversion to Diesels	2	3	5	6	7		9
TOTAL ALT. F	36	36	55	72	91	40	33

- From Fremont to Third

	<u>INBOUND</u>		<u>OUTBOUND</u>		<u>TOTAL</u>		<u>OVERALL AVERAGE FREQUENCY</u> (IN SECONDS)	
	4:30- 5:30	PEAK 20-MIN. RATE	4:30- 5:30	PEAK 20-MIN. RATE	4:30- 5:30	PEAK 20-MIN. RATE	4:30- 5:30	PEAK 20-MIN.
Existing	32	36	63	87	95	123	38	29
+ Dieselized #8	16	12	18	24	34	36		
+ Minimum Diversion to Diesels	2	3	5	6	7	9		
TOTAL ADT P	50	51	86	117	136	168	26	21

As the charts indicate, Alternative F would mean frequent operation of diesel buses on most of beautified Lower Market Street. This would cause an increase in the production of noise peaks there, varying somewhat with the location on Market.

Below Fremont, rush-hour diesel bus noise production would approximately double as overall frequencies would increase from one diesel every 82 seconds on average to one every 42 seconds on average. There would be a proportionately smaller increase in frequency in the retail core, between Fourth and Fifth, from one diesel every 72 seconds on average to one every 40. The worst noise situation would be found between Fremont and Third with a resulting total diesel bus volume of 136 from 4:30 to 5:30, or one every 26 seconds on average.

These figures do not reflect noise produced by diesel buses crossing Market Street, such as those on the 15-Third and Kearny, 42-Third and Evans and 30-Stockton Express lines.

--Upper Market

Disregarding the few routes which cross or terminate at Market Street, Upper Market is now free of diesel buses; this would be changed by Alternative F, which would require dieselization of the 8-Market line. Assuming a one-for-one substitution of diesels for trolleys, this would mean a combined inbound and outbound diesel bus volume of 34 in the evening rush hour, an average of one every 1 3/4 minutes.

5.2 Air Pollution

Like Alternatives C, D and E, Alternative F would increase the Railway's diesel bus operations in the downtown area. Weekday diesel bus mileage operated on Market Street would almost double from its present 1,029.2 miles to 2,051.5 miles. Based on the average per-vehicle-mile emission rates for 1973 determined by the Bay Area Air Pollution Control District, estimated weekday diesel bus pollutant production on Market Street would increase as follows:

<u>Pollutant</u>	<u>Present (Alternatives A,B)</u>	<u>Alternative F</u>
Particulates	1,543.8 grams	3,077.6 grams
Organics	1,749.6 grams	3,487.6 grams
NOx (Nitrogen Oxides)	53,518. grams	106,668 grams
SO ₂ (Sulfur Dioxide)	720.4 grams	1,435.9 grams
CO (Carbon Monoxide)	30,876 grams	61,539 grams

5.3 Visual Intrusion

- a. Alternative F would reduce the visual impact of transit on Market Street by removing the on-street overhead wires.
- b. Alternative F would not result in a change in the visual environment of Sutter or Post Streets, other than that due to the installation of additional special work at Van Ness Avenue.
- c. Alternative F would reduce visual intrusion on some streets where transit service would be discontinued and/or overhead removed:

- on McAllister from Van Ness to Market
- on Hyde from McAllister to Market
- on Grove from Van Ness to Polk
- on Polk from Grove to Market
- On Eighth from Market to Mission
- on Ninth from Mission to Market

d. Alternative F would cause visual intrusion on two streets where trolley wire would have to be installed:

- on Octavia from Page to Grove
- on Cough from Hayes to Haight

e. Alternative F would not reduce the visual intrusion of trolley coach wires crossing Market at:

- Main-Drum and Davis-Beale
- Third-Kearny and Stockton-Fourth
- Van Ness Avenue
- Church Street

3.4 Second - Order Effects

The poor transit service rendered by Alternative F would considerably diminish MUNI's potential to act as a tool to reduce environmental pollution by serving as an attractive alternative to the automobile. The opportunity to cut Downtown automobile usage, its consequent air and noise pollution and energy requirements and demand for parking would be lost.

Sub-Alternative G--Partial Re-Route of 8-Market Trolley
Coach via Duboce Avenue and Mission Street (Figure 9)-

This is not a full alternative dealing with the re-routing of all the Market Street trolley coach lines, but an optional treatment of the 8-Market line only, which would serve as an alternative to its dieselization. As an option it would be applicable to Alternatives C, D, E and F. Under this proposal, the 8-Market would be operated as a trolley coach line and be routed as follows:

From 19th and Castro, north on Castro, east on Market as at present only as far as Duboce, then east on Duboce to Mission and north and east on Mission to the Ferry; returning west and south on Mission and Otis to Duboce, west on Duboce to Market, then outbound as at present via Market, Castro, 18th, Collingwood and 19th to Castro.

The proposed routing is a "hybrid," an attempt to reconcile electric operation of the #8 with a "wire-free" lower Market Street by diverting the Lower Market segment of the line to Mission Street. The technical feasibility of this proposal is due to the agreement of the Transit Task force to retention of overhead wire on Upper Market Street, confirmed at the meeting of the Mayor's Advisory Committee on Upper Market Street held on April 17, 1975.

Some modification and addition to the overhead wire system would be entailed in this proposal; assuming that support poles would be available west of Duboce and Market, and assuming installation of new wire, we would estimate a net present capital cost for overhead as follows:

11,750 feet of grooved trolley wire @ \$1.60 per foot	=	\$ 18,800.
2 selectric switches @ \$3,500 each	=	\$ 7,000.
2 trailing frogs @ \$1,800 each	=	\$ 3,600.
12 crossovers @ \$2,000 each	=	\$ 24,000.
40 poles @ \$2,000 each	=	\$ 80,000.
80 spans @ \$4,000 each	=	\$ 32,000.
Material Subtotal	=	\$165,400.
Engineering (10%)		16,540.
Contingencies (10%)		16,540.
		<hr/>
TOTAL		\$198,480.
		<hr/>

At 6½% interest, the annual payment over the 30-year assumed life of the overhead would be:

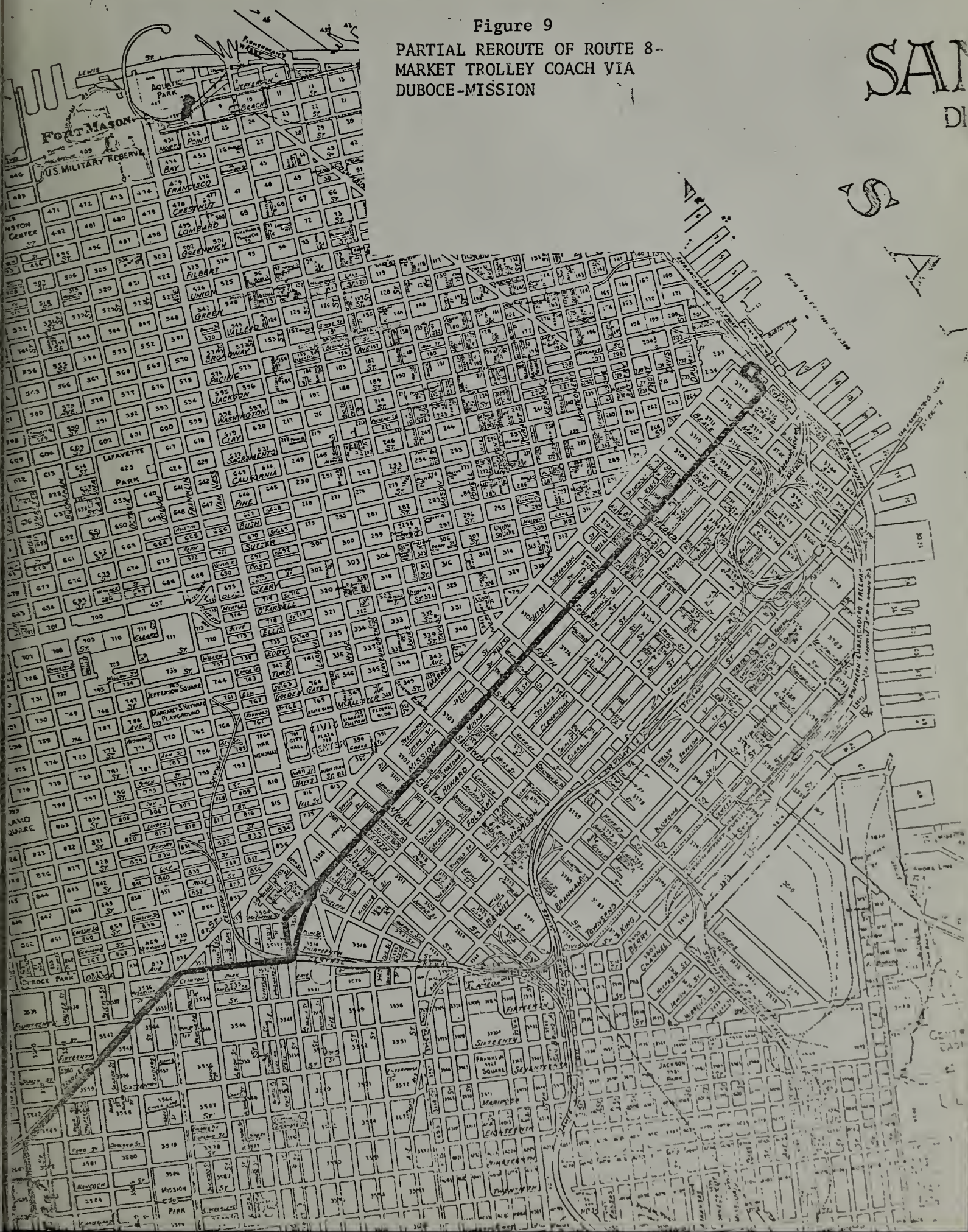
$$\$198,480 (.07658) = \$15,199.59840$$

The present value of these payments for a 20-year operating period would be:

$$\$15,199.59840 (11.0185) = \$167,476.77$$

Figure 9
 PARTIAL REROUTE OF ROUTE 8-
 MARKET TROLLEY COACH VIA
 DUBOCE-MISSION

SAN
 DI



This proposal would lower the cost of the Alternative to which it is applicable by obviating the need to purchase diesel buses for the #8 line; this would be partially offset by the cost of overhead; but in all there could be a reduction of about \$2.4 million in the cost of Alternatives C, E and F. The reduction in cost of Alternative D would be much less, about \$350,000, because of the congestion delay on Mission Street and the resulting increase in vehicle requirements.

However, these savings could only be purchased at a high price--the discontinuance of through transit service on Market Street. The #8 Line is, of course, the main through trunk route running the length of Market from the Ferry to Castro; re-routing it to Mission would eliminate this as its basic function. It is hard to imagine Market Street without a through transit route; it would also be hard to find a more obvious contravention of the transit design principles stated in the Transportation Element of the City's Master Plan. "Lines named for streets...should stay on those streets as much as possible," and "Routes should, to the extent possible, run in straight lines between well-known termini."

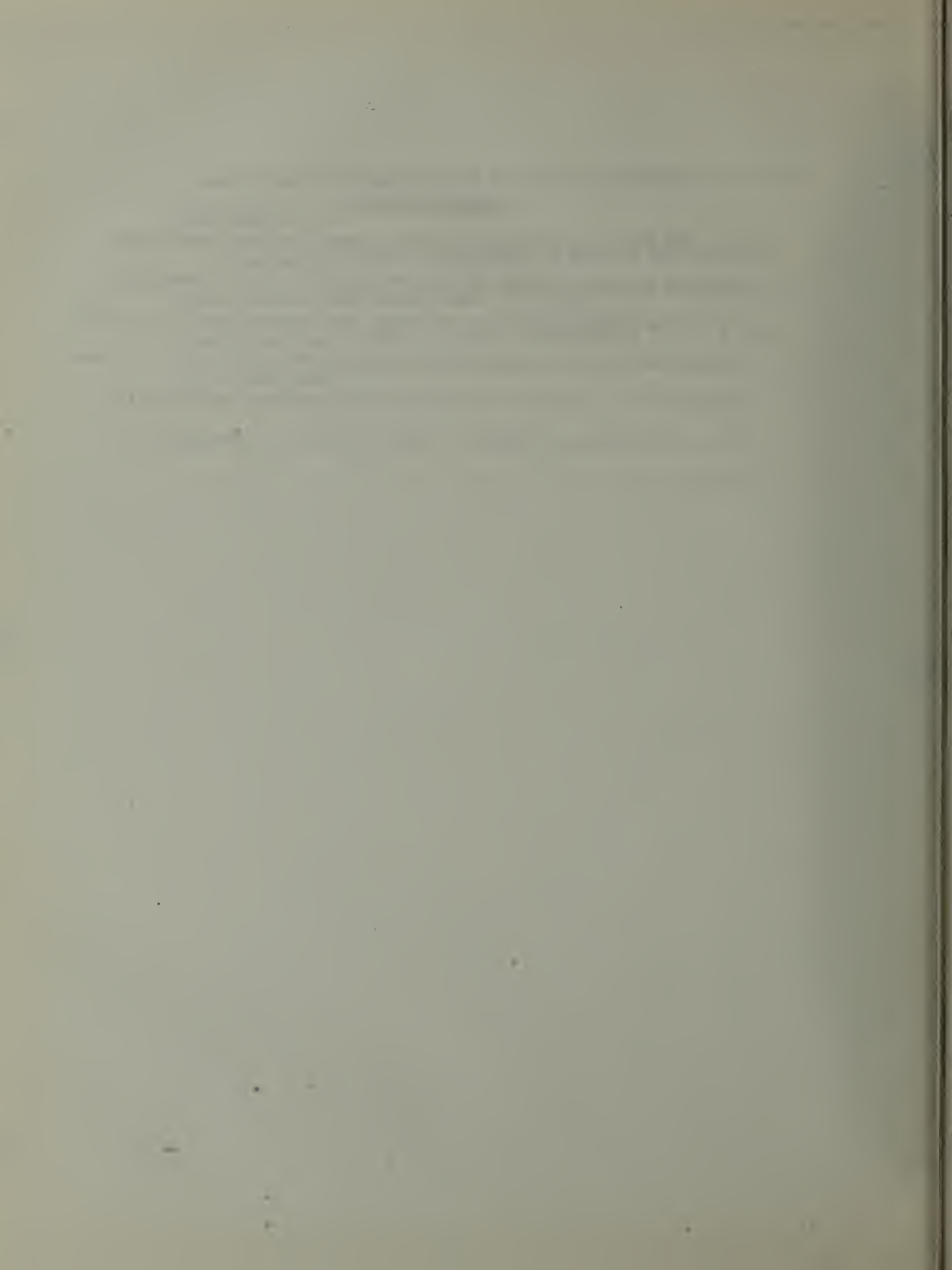
The rerouted #8 line would also be subject to the same weaknesses found in Alternative D--the shift in catchment area of Downtown stops and reduction in usefulness of the line by moving

it away from the concentrations of transit passenger destinations (see Appendix I).

Alternative G would also produce a service gap on Market Street between Duboce and Gough; there would be no transit service of any kind on this stretch--a distance of 1/5 of a mile on a steady grade.

Evaluation Matrix

The following evaluation matrix compresses into three pages the main points discussed in the Alternatives. The Alternatives are listed across the top of the page, with the evaluation criteria listed down the side--operations impacts on the first page, service impacts on the second, environmental considerations on the third. The Alternatives are ranked for each criterion in the right hand column.



ALTERNATIVE

ALTERNATIVE A:
TROLLEYCOACH
OPERATION A
MARKET STREET

ALTERNATIVE B:
KINETIC ENERGY
WHEEL

ALTERNATIVE C:
ALTER TROLLEY
TUNDRACK LOOPS
VIA
MISSION STREET

ALTERNATIVE D:
REROUTE TROLLEY-
COACHES VIA HO-
WARD/POLOMAN ST,
POST'S STREETS

ALTERNATIVE E:
REROUTE TROLLEY-
COACHES VIA HO-
WARD/POLOMAN ST,
POST'S STREETS

ALTERNATIVE F:
REROUTE TROLLEY-
COACHES VIA SUTTER/
POST'S STREETS

CRITERIA

1.1 + 1.2 =
1.3
Additional
Capital and
Operating
Costs for 20-year
Operating
Period

RANK	ALTERNATIVE
1	A
2	D
3	E
4	D
5	C
6	F

\$1.5 million

\$3.0 million

\$7.1 million

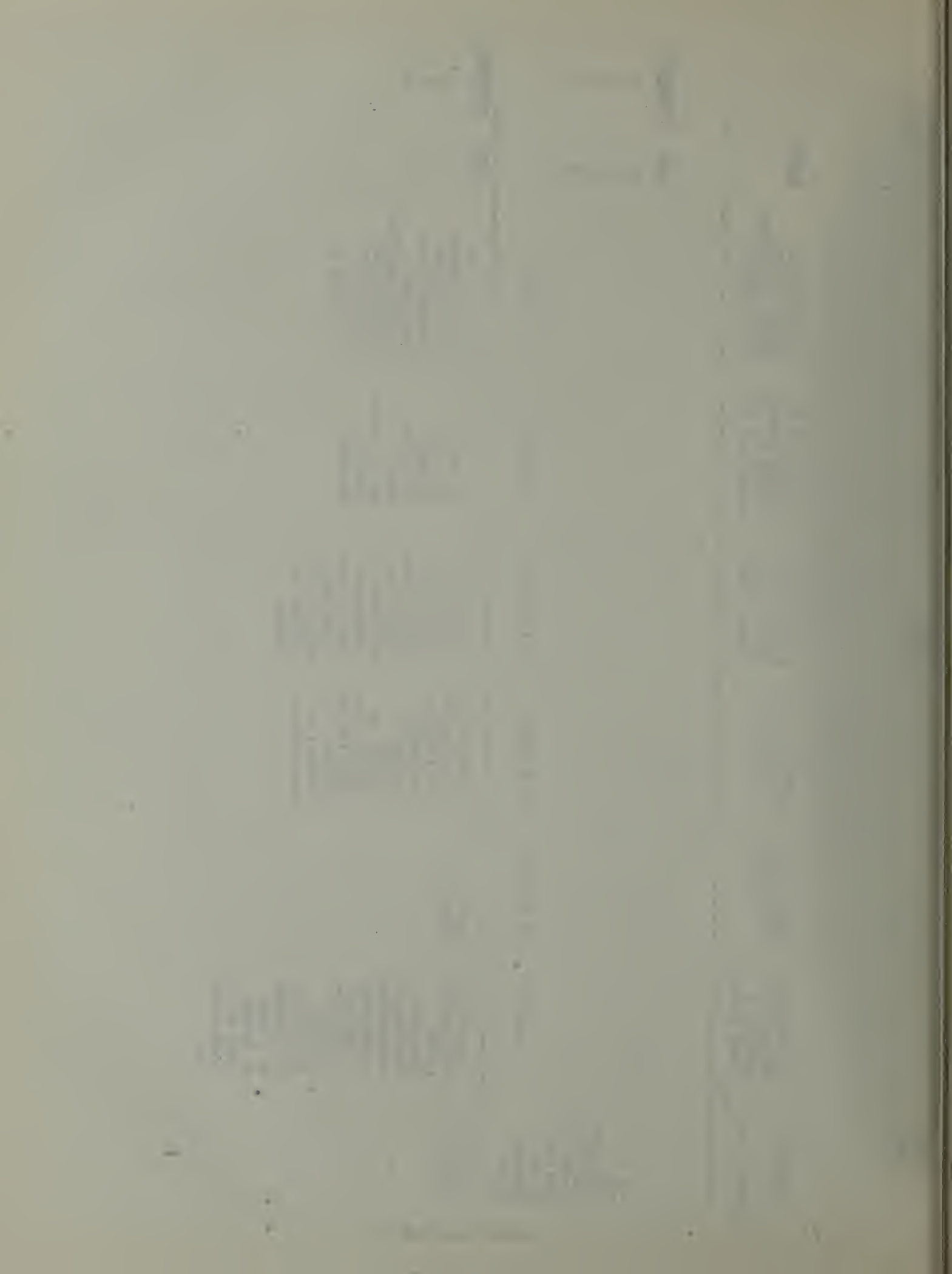
\$9.8 million

\$1.9 million

\$10.6 million

RANK	ALTERNATIVE
1	A,B
2	E
3	C
4	D,F
5	

1.4 Schedule Adherence
A decline in BART and Market St. Beautification-related construction should result in improved schedule reliability. This reliability will be sustained as a result of no left turns and truck loading bays.
Same as Alternative A.
Increasing movements via 7th, 8th & 9th St. and Mission would place turning trolleys in conflict with heavy flow of Mission trolleys and auto traffic.
Significant increase in trolley coach volumes and limited street capacity would contribute to a deterioration of operational capabilities and schedule adherence.
Low transit and auto volumes on the couplet should permit adequate schedule adherence.
High auto and transit volumes on Post/Sutter currently cause operational difficulties. The situation would significantly worsen with Alternative F.



ALTERNATIVE	ALTERNATIVE A: TROLLEYCOACH OPERATION ON MARKET STREET	ALTERNATIVE B: KINETIC ENERGY WHEEL	ALTERNATIVE C: TURNBACK LOOPS VIA MISSION STREET	ALTERNATIVE D: PE-ROUTE TROLLEY COACHES VIA MISSION STREET	ALTERNATIVE E: PE-ROUTE TROLLEY COACHES VIA HOWARD/FOLSON ST.	ALTERNATIVE F: PER-ROUTE TROLLEY COACHES VIA SUTTER/POW ST.	RANKING
CRITERIA							
2.1 Accessibility	Patrons have convenient access to jobs, retail and entertainment opportunities, easy transfers to north-south lines; good access to regional systems.	Same as Alternative A.	Severe decrease in no-transfer accessibility to jobs, retail and entertainment opportunities; second transfer introduced between Muni and regional systems; second transfer introduced between lines 5, 6, 7, 21 and North-South lines Downtown. Very poor access to regional systems.	Shift in route means large concentration of jobs, retail and entertainment opportunities now served by lines 5, 6, 7 and 21 will be outside catchment area of stops. Poor access to BART, though good to AC, OK to SP and GGT.	Poor; Howard and Folson are at too great a distance from most Downtown activity centers to make operation worthwhile, though OK to Beale/Main and Embarcadero Center. Poor access to BART, OK to AC, SP, GGT, regional systems.	Service to retail and entertainment concentrations north of Market maintained from 5th to Van Ness, and near Ferry lost. Transferring unsatisfactory. Poor access to regional systems.	RANK 1 3 4 ALTERNATIVE A, B D C, E, F
2.2 Travel Time	Shortest travel times to and from retail area, overall travel times to and from Financial District faster than other Alternatives	Same as Alternative A.	Travel times increased to destinations east of Civic Center, except to vicinity of subway entrances in Financial District for Muni Metro transfers.	Travel times increased to destinations north of Market for psgrs. on lines 5, 6, 7 and 21, also to destinations south of Market for psgrs. on lines 9, 12, 14 because of trolley congestion on Mission	Travel times increased to destinations east of Civic Center.	Overall travel time to Downtown Financial District jobs, to major shopping and entertainment would increase. Muni Metro transfer for quick trip to Lower Market not possible.	RANK 1 3 6 ALTERNATIVE A, B C, D, E F
Reliability	Good long-term viability of routes excellent.	Same as Alternative A.	Difficult looping movements under conditions in transit lines of service tend down.	Heavy trolley volumes cause unstable, extremely short headways; frequent delays; bunching probable; no leapfrogging possible to regain schedules.	Provide Financial District looping problem is solved, reliability should be good.	Transit vehicles volumes on Sutter and Powell will be very high, an unstable condition conducive to breakdowns in reliability.	RANK 1 3 4 5 ALTERNATIVE A, B E C D, F

ALTERNATIVE A:
 TROLLEYCACH
 OPERATION ON
 MARKET STREET
 CRITERIA
 ALTERNATIVE B:
 KINETIC
 ENERGY WHEEL
 ALTERNATIVE C:
 TURNBACK LOOPS
 VIA
 MISSION STREET
 ALTERNATIVE D:
 RE-ROUTE TROLLEY-
 COACHES VIA
 MISSION STREET
 ALTERNATIVE E:
 RE-ROUTE TROLLEY-
 COACHES VIA
 HOWARD/FOLSOM ST.
 ALTERNATIVE F:
 RE-ROUTE TROLLEY-
 COACHES VIA SUTTER/
 POST STREETS
 RANKING

3.1 Noise	ALTERNATIVE A: TROLLEYCACH OPERATION ON MARKET STREET	ALTERNATIVE B: KINETIC ENERGY WHEEL	ALTERNATIVE C: TURNBACK LOOPS VIA MISSION STREET	ALTERNATIVE D: RE-ROUTE TROLLEY- COACHES VIA MISSION STREET	ALTERNATIVE E: RE-ROUTE TROLLEY- COACHES VIA HOWARD/FOLSOM ST.	ALTERNATIVE F: RE-ROUTE TROLLEY- COACHES VIA SUTTER/ POST STREETS	RANK	ALTERNATIVE
	Maximum use of electric vehicle Downtown; no need to dieselized #8 line.	Same as Alternative A.	Heavy reliance on diesel buses Downtown; 4:30-5:30 volumes: Ferry to Fremont-132, Fremont to Third-189, Fourth to Fifth - 144.	Heavy reliance on diesel buses Downtown; 4:30-5:30 volumes: Ferry to Fremont-89, Fremont to Third-140, Fourth to Fifth-101.	Heavy reliance on diesel buses Downtown; 4:20-5:30 volumes: Ferry to Fremont-85, Fremont to Third-135, Fourth to Fifth 91.	Heavy reliance on diesel buses Downtown; 4:20-5:30 volumes: Ferry to Fremont-85, Fremont to Third-135, Fourth to Fifth 91.	1 2 3 4 5	A, B F D E C

(Peak rates higher) (Peak rates higher) (Peak rates higher)

3.2 Air Pollution	ALTERNATIVE A: TROLLEYCACH OPERATION ON MARKET STREET	ALTERNATIVE B: KINETIC ENERGY WHEEL	ALTERNATIVE C: TURNBACK LOOPS VIA MISSION STREET	ALTERNATIVE D: RE-ROUTE TROLLEY- COACHES VIA MISSION STREET	ALTERNATIVE E: RE-ROUTE TROLLEY- COACHES VIA HOWARD/FOLSOM ST.	ALTERNATIVE F: RE-ROUTE TROLLEY- COACHES VIA SUTTER/ POST STREETS	RANK	ALTERNATIVE
	Maximum use of electric vehicles Downtown; no need to dieselize #3 line.	Same as Alternative A.	Maximum production of diesel bus pollutants on Market-269% of Alt. A.	High production of diesel bus pollutants on Market-219% of Alt. A.	High level of production of diesel bus pollutants on Market-225% of Alt. A.	High level of production of diesel bus pollutants on Market-199% Alt. A.	1 2 3 4 5 6	A, B F D D E C

(Peak rates higher) (Peak rates higher) (Peak rates higher)

3.3 Visual Intrusion	ALTERNATIVE A: TROLLEYCACH OPERATION ON MARKET STREET	ALTERNATIVE B: KINETIC ENERGY WHEEL	ALTERNATIVE C: TURNBACK LOOPS VIA MISSION STREET	ALTERNATIVE D: RE-ROUTE TROLLEY- COACHES VIA MISSION STREET	ALTERNATIVE E: RE-ROUTE TROLLEY- COACHES VIA HOWARD/FOLSOM ST.	ALTERNATIVE F: RE-ROUTE TROLLEY- COACHES VIA SUTTER/ POST STREETS	RANK	ALTERNATIVE
	Overhead wires on Market from the Ferry to Castro Street.	Overhead wires on Market from Van Ness to Castro; overhead crossing Lower Market at Van Ness and other locations.	No overhead wires on Market; overhead crossing Lower Market at Van Ness and other locations.	No overhead wires on Market; overhead crossing Lower Market at Van Ness and other locations.	No overhead wires on Market; overhead crossing Lower Market at Van Ness and other locations.	No overhead wires on Market; overhead crossing Lower Market at Van Ness and other locations.	1 2 3 4 5 6	F C, D, E B A

3.4 Second-order effects	ALTERNATIVE A: TROLLEYCACH OPERATION ON MARKET STREET	ALTERNATIVE B: KINETIC ENERGY WHEEL	ALTERNATIVE C: TURNBACK LOOPS VIA MISSION STREET	ALTERNATIVE D: RE-ROUTE TROLLEY- COACHES VIA MISSION STREET	ALTERNATIVE E: RE-ROUTE TROLLEY- COACHES VIA HOWARD/FOLSOM ST.	ALTERNATIVE F: RE-ROUTE TROLLEY- COACHES VIA SUTTER/ POST STREETS	RANK	ALTERNATIVE
	Good opportunity to use transit as at reduced auto and its environmental effects.	Same as Alternative A.	Reduces transit's potential use to reduce auto use and its environmental effects.	Same as Alternative C.	Same as Alternative C.	Same as Alternative C.	1 2	A, B C, D, E, F

Conclusions and Recommendations

Analysis of the evaluation matrix indicates that those alternatives which maintain a Market Street routing (Alternative A: Trolley Coach Operations on Market Street and Alternative B: Installation of the Kinetic Energy Wheel) consistently perform better than all other alternatives, except that under Criterion 3.3: Visual Impact, Alternative A does poorly. Based upon their performance under these criteria, the Alternatives which require a rerouting off Market Street or a turnback at Market Street--Alternatives C, D, E, F and G--would provide a limited benefit (improved visual environment on Market Street) at the considerable expense of:

- decreased transit accessibility to Downtown jobs, shopping and entertainment;
- increased transit travel times;
- a greater use of diesel buses, contrary to City policy;
- poor operating conditions leading to unreliability and higher capital and operating costs for the Municipal Railway;
- increased Downtown noise and air pollution, concentrated on a beautified Market Street;
- a reduction in transit's potential use as a tool to improve the urban environment by decreasing reliance on the automobile.

It would take an extraordinarily narrow view of urban environmental quality, virtually placing sole emphasis on one definition of visual aesthetics, to assert that rerouting trolleys off Market Street could in some way justify the large costs which such an action would entail. We do not believe, in light of the increasing recognition of the importance of quality transit service and an awareness of the wider scope of environmental concern, that such a narrow view of urban environmental quality is justifiable.

Accordingly, and with reference to the preceeding analysis of Alternatives, we recommend that the Market Street routing of trolley coach lines 5, 6, 7, 8 and 21 be retained, and that the Management of the Municipal Railway of San Francisco and the Public Utilities Commission of the City and County of San Francisco reject proposals to reroute or de-electrify the Market Street segments of trolley coach lines 5, 6, 7, 8 and 21 (Alternatives C, D, E, F, and, therefore, G) as costly, impracticable, unfair to transit patrons and environmentally unsound.

There remains the issue of the relative merits of Alternative A: Trolley Coach Operation on Market Street, and Alternative B: Installation of the Kinetic Energy Wheel. Both these Alternatives score significantly better in cost comparisons than the reroute and turnback Alternatives C through G, but there remains nonetheless a large difference in cost between them; the estimated

added cost of KEW installation is, even with the low Woods estimate, almost twice that of installing new trolley coach wires. Of course, at this cost, there would be an improvement in visual quality through the removal of most Lower Market Street trolley wire; wire crossing Lower Market Street at Main-Drumm, Davis-Beale, Third-Kearney and Stockton-Fourth Streets and at Van Ness Avenue would remain, as would the trolley wire on Market Street from Van Ness Avenue west.

Regrettably, the choice between Alternatives A and B is not simply one of the tradeoff between cost and visual intrusion. There are doubts about the cost of the kinetic energy wheel itself. The price we have quoted in this paper is based on the estimate supplied in the Lawson-Woods study; however, given the recent history of skyrocketing costs in the transit industry, the very high Lockheed cost estimate of 1974 and the absence of any actual bids on a project of this kind, we cannot be assured that the costs on which this analysis is based would be those actually incurred by the City should it choose to implement Alternative B. Similarly, the lack of empirical evidence leaves doubt about the ability of a kinetic energy wheel-equipped vehicle to perform consistently and reliably under the demanding transit conditions experienced on Market Street. In short, we don't know if it will work, and if it does work what it will cost. It appears that to answer these questions, a trial KEW program would have to be

started and operated in some part of the City where the danger of disruption to the Municipal Railway's major trunk lines could be minimized. Market Street is emphatically not the place for an experiment of this variety.

In the meantime, the City is faced with both an as yet unresolved trolley-on-Market Street question and a problem of deteriorating temporary poles and overhead on Market Street. The resolution of these issues cannot wait the several years required to come to a conclusion, supported by empirical evidence, that kinetic energy wheel operation of trolley-coach lines 5, 6, 7, 8 and 21 from Van Ness Avenue to the Ferry might be feasible.

Under the circumstances, therefore, we recommend that detailed engineering for a new and permanent installation of modern trolley coach overhead--based as much as possible on suspension from eyebolts and as aesthetically acceptable as possible--be undertaken immediately, to be followed by rapid installation to facilitate removal of unsightly temporary wooden poles from a beautified Market Street. Should the City at some future date, based on evidence derived from an experimental operation it may wish to conduct, decide to apply the kinetic energy wheel concept to Market Street operation, the wire east of Van Ness could be removed. If most of the overhead suspension is from eyebolts, this would leave little evidence of former trolley operation. Most of the

cost of trolley coach overhead installation is in underground feeder cable and support poles; the underground feeder is minimal on Market Street and the pole cost could be kept low by maximizing the use of eyebolts. In this way the net investment which would be lost, should overhead be removed at some later date east of Van Ness Avenue, would be low. The wire from Van Ness Avenue west would, in any event, have to be retained, even with KEW operation.

To reiterate, based on the foregoing analysis, we recommend to the Management of the Municipal Railway and the Public Utilities Commission of the City and County of San Francisco that:

1. Proposals to reroute or de-electrify the Market Street segments of trolley coach lines 5, 6, 7, 8 and 21 be rejected;
2. Detailed engineering for a new and permanent overhead trolley installation from the Ferry to Castro Street--based insofar as possible on suspension from eyebolts--be undertaken immediately;
3. Rapid installation of new overhead from the Ferry to Castro Street follow upon completion of engineering work.

Appendix A:

Capital Cost of Market Street Overhead

HETCH HETCHY WATER AND POWER

BUREAU OF LIGHT, HEAT AND POWER

855 HARRISON STREET
SAN FRANCISCO, CALIFORNIA 94107
558-3821



May 15, 1975

Subject: Market Street Trolley Coach
Overhead Reconstruction Estimate

Mr. James J. Finn
Transportation Director
949 Presidio Avenue
San Francisco, California 94115

Dear Mr. Finn:

In answer to your request that we compile a cost estimate for a new trolley coach overhead system along Market Street, we are sending the attached tabulation of needed items amounting to a total of \$1,700,000. To derive this cost we have had to make certain assumptions and preliminary design criteria such as the following:

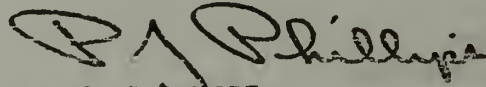
- a) That we will not use any existing new "Path of Gold" poles.
(There is some question about the porcelain cracking and the foundations being strong enough);
- b) That the owners of contiguous property will grant us permission to install span retaining eyebolts on building facades whenever possible, (approximately 87 are contemplated);
- c) That conventional trolley poles will be placed at locations where eyebolts are impractical. This is considerably more difficult than the usual placement of poles on plain sidewalks;
- d) That existing trolley coach turns and routes are retained;
- e) That existing overhead hardware and trolley wire is worn and should be replaced, except that the steel trolley poles existing between McCoppin and Castro Streets may continue in service.

May 15, 1975

Aside from the foregoing assumptions, we are very cognizant that the basic policy of routing or not routing trolley coaches along Market Street, which is being aesthetically reconstructed at considerable expense, has not yet been resolved. We will be happy to assist in implementing the basic policy once it has been adopted by the proper authorities.

Should you need any further assistance from us, please let us know.

Very truly yours,


for O. L. MOORE
General Manager

Enc.

Market Street Trolley Coach
Overhead Reconstruction
Cost Estimate

<u>Item</u>	<u>Quantity</u>	<u>Price</u>	<u>Extension</u>
Eyebolt	87 ea	\$240 ea	\$20,880
Trolley Pole	60 ea	\$3,500 ea	\$210,000
Tangent span plain	82 ea	\$350 ea	\$28,700
Tangent span equalizer	41 ea	\$375 ea	\$15,375
Tangent span feeder	41 ea	\$410 ea	\$16,840
Duct bank 4-4"	5,100 ft	\$60/ft	\$306,000
Manhole	12 ea	\$4,500 ea	\$54,000
Circuit Breaker	6 ea	\$33,500 ea	\$201,000
Feeder riser cable (pos.)	2,500 ft	\$6.50/ft	\$16,250
Feeder riser cable (neg.)	2,650 ft	\$5.25/ft	\$14,000
Conduit (riser)	4,750 ft	\$8.50/ft	\$40,375
Cable (pos.)	15,300 ft	\$7.50/ft	\$114,750
Cable (neg.)	15,300 ft	\$6.50/ft	\$99,450
Grooved Trolley Wire	62,000 ft	\$1.60/ft	\$99,200
Castro-Market Special Work			\$7,000
Church-Market Special Work			\$23,000
Haight-Market Special Work			\$7,500
Page-Market Special Work			\$6,800
Van Ness-Market Special Work			\$19,300
Polk-Market Special Work			\$6,800
Hayes-Market Special Work			\$7,500
Hyde-Market Special Work			\$18,900
McAllister-Market Special Work			\$7,500
4th-Market Special Work			\$17,300
3rd-Market Special Work			\$15,700
Beale-Market Special Work			\$9,900
Main-Market Special Work			\$9,900
Subtotal			\$1,393,920
Contingencies 10%			\$139,400
Engineering and Inspection			\$139,400
Total			\$1,672,720
			OF
			\$1,700,000

Compiled on May 14, 1975

Trolley Overhead
Market Street Intersections
Special Work

A. <u>Castro - Market Special Work</u>	(#8)
Pulloffs and tension guys	\$1,000
8 curve segments	4,800
2 "no boes"	200
	<hr/>
	\$6,000
Installation	1,500
	<hr/>
	\$7,500
 B. <u>Church-Market Special Work</u>	 (J-22 Xing)
4 special pantograph - trolley coach	
devices at say \$5,000 each	\$20,000
Installation	3,000
	<hr/>
	\$23,000
 C. <u>Haight-Market Special Work</u>	 (#7 OB)
1 Selective switch	\$3,500
Pulloffs and tension guys	1,000
Installation	3,000
	<hr/>
	\$7,500
 D. <u>Page-Market Special Work</u>	 (#7 IB)
1 Crossover	\$2,000
1 Trail frog	1,800
Pulloffs and tension guys	1,500
Installation	1,500
	<hr/>
	\$6,800

E. South Van Ness and Market Special Work (#47 Xing)

1 Selectric Switch	\$3,500
1 Trail frog	1,800
4 Crossovers	8,000
Installation	8,000

\$19,300

F. Polk-Market Special Work (#21 IB)

1 Crossover	\$2,000
1 Trail frog	1,800
Pulloffs and tension guys	1,500
Installation	1,500

\$6,800

G. Hayes-Market Special Work (#21 OB)

1 Selectric Switch	\$3,500
Pulloffs and tension guys	1,000
Installation	3,000

\$7,500

H. Hyde-Market Special Work (#5 IB)

2 Crossovers	\$4,000
1 Selectric Switch	3,500
1 Trail frog	1,800
1 Curve segment	600
Pulloffs and tension guys	3,000
Installation	6,000

\$18,900

I. McAllister-Market Special Work (#5 OB)

1 Selectric Switch	\$3,500
Pulloffs and tension guys	1,000
Installation	3,000

\$7,500

J. <u>4th and Market Special Work</u>	(#30 IB)
1 Selectric Switch and trail frog	\$5,400
2 Crossovers	4,000
4 Curve segments	2,400
Pulloffs and tension guys	2,000
Installation	3,500
	<hr/>
	\$17,300

K. <u>3rd and Market Special Work</u>	(#30 OB)
1 Trail frog	\$1,800
3 Crossovers	6,000
4 Curve segments	2,400
Pulloffs and tension guys	2,500
Installation	3,000
	<hr/>
	\$15,700

L. <u>Beale-Market Special Work</u>	(#41 IB)
2 Crossovers	\$4,000
4 Curve segments	2,400
Pulloffs and tension guys	1,500
Installation	2,000
	<hr/>
	\$9,900

M. <u>Main and Market Special Work</u>	(#41 OB)
2 Crossovers	\$4,000
4 Curve segments	2,400
Pulloffs and tension guys	1,500
Installation	2,000
	<hr/>
	\$9,900

Appendix B:

Department of Public Health:

MUNI Noise Survey

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC HEALTH

CENTRAL OFFICE
101 GROVE STREET
SAN FRANCISCO, CALIFORNIA 94102

March 20, 1975

Subject: Noise Level Survey
San Francisco MUNI

Mr. James J. Finn
Director of Transportation
Public Utilities Commission
287 City Hall
San Francisco, Ca. 94102

Dear Mr. Finn:

In accordance with request contained in letter of 13 March, 1975, a noise level survey of San Francisco MUNI Transportation Vehicles has been conducted by the Noise Control Section of our Bureau of Environmental Health Services.

The results of this survey indicate:

1. the ambient noise levels at the selected intersections vary from 65 to 71 decibels;
2. MUNI diesel buses were measured with peaks from 74 to 92 decibels;
3. MUNI electric buses created sound pressure levels from 69 to 84 decibels.
4. MUNI electric trolleys created peaks from 72 to 84 decibels.

A tabulation of these findings with appropriate explanatory notes and legends, as well as sound signature tracings from which these data were derived, is attached.

Very truly yours,

Francis J. Curry, M.D.

FRANCIS J. CURRY, M.D.
Director of Public Health

Attachments

20 March 1975

Publication of Findings:

ORIGIN OF DIFFERENTIAL SOUND IN DB OF TSP

Location & Time	Ambient	Diesel (DB)	Electric (dB)	Electric (dB)	Autos (dB)	Trucks (dB)	Station (dB)
Stewart & Market 3/18/75 4:30 pm	68	10/88/76/81	9/75/69/72	none	4/77/69/74	none	1/75/75/75
5th & Market 3/18/75 4:45 pm	67	4/85/74/79	8/30/70/75	3/80/78/79	7/32/78/79	3/82/78/81	4/38/78/85
11th & Market 3/18/75 5:05 pm	65	3/87/78/84	26/84/76/79	16/80/78/82	13/78/68/74	3/78/65/76	3/76/68/73
Stewart & Mission 3/19/75 7:30 am	68	1/85/85/85	9/72/73/75	none	16/84/71/76	9/73/75/77	2/80/72/76
5th & Mission 3/19/75 7:45 am	71	6/83/76/79	7/82/77/80	none	10/80/77/79	4/90/78/83	2/82/82/82
11th & Mission 3/19/75 8:00 am	71	5/92/78/82	13/78/71/75	none	8/78/75/77	7/90/80/84	2/35/81/85

* Legend: # Events/ MI -dba/ Low - dbA/ Meq - dbA

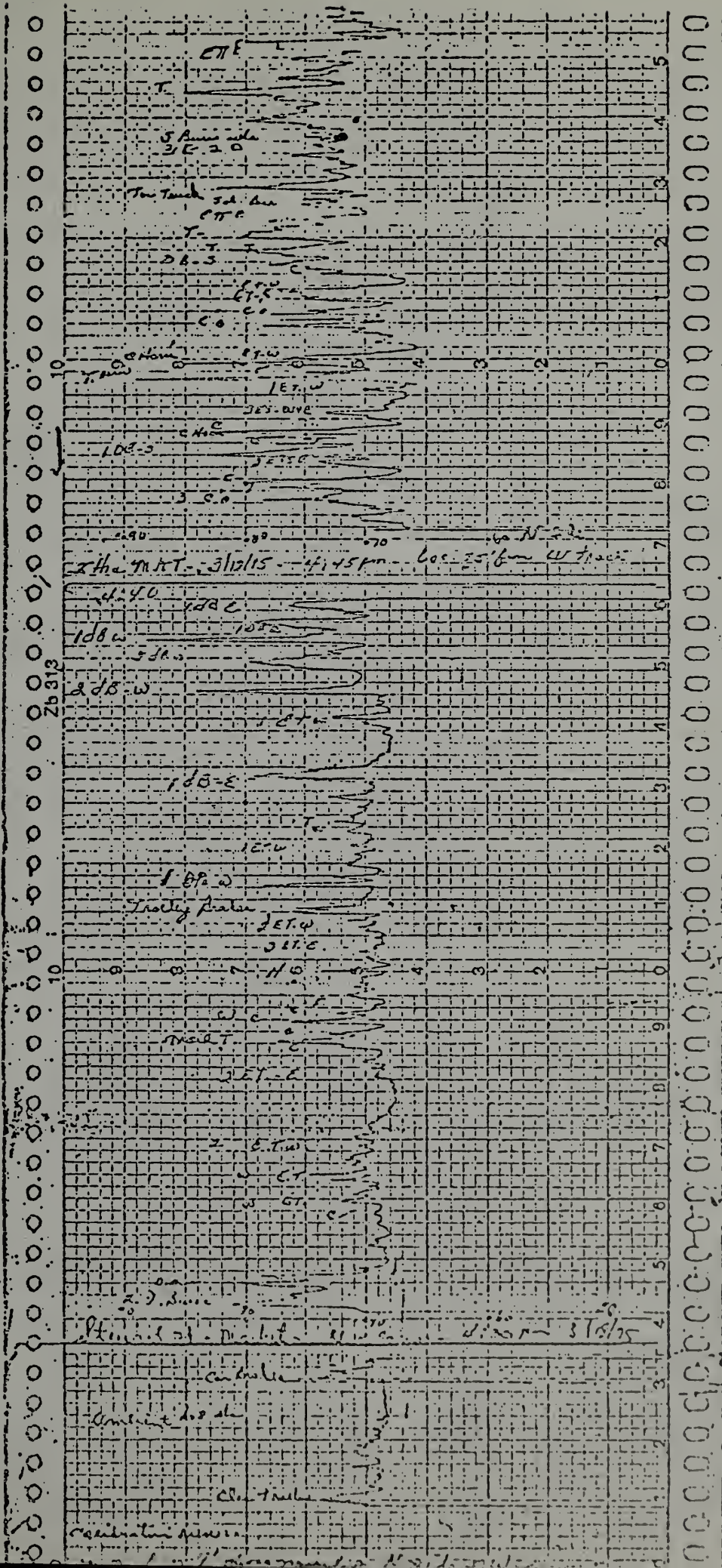
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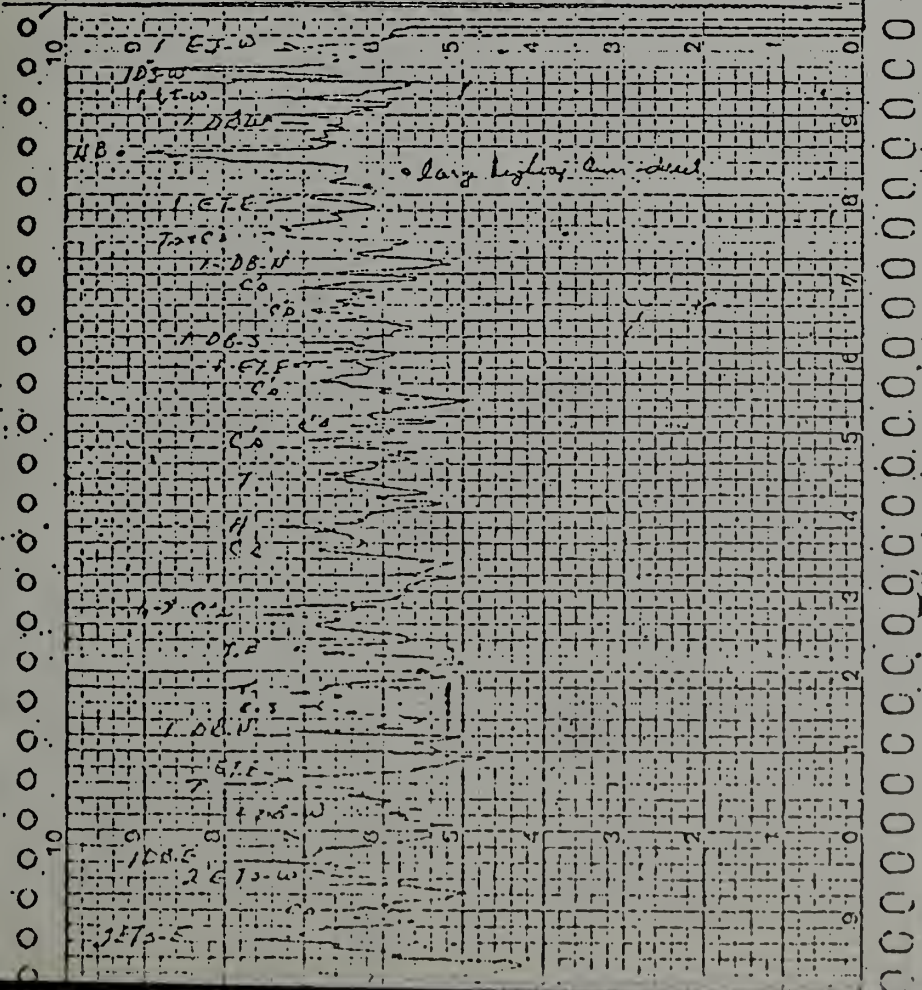
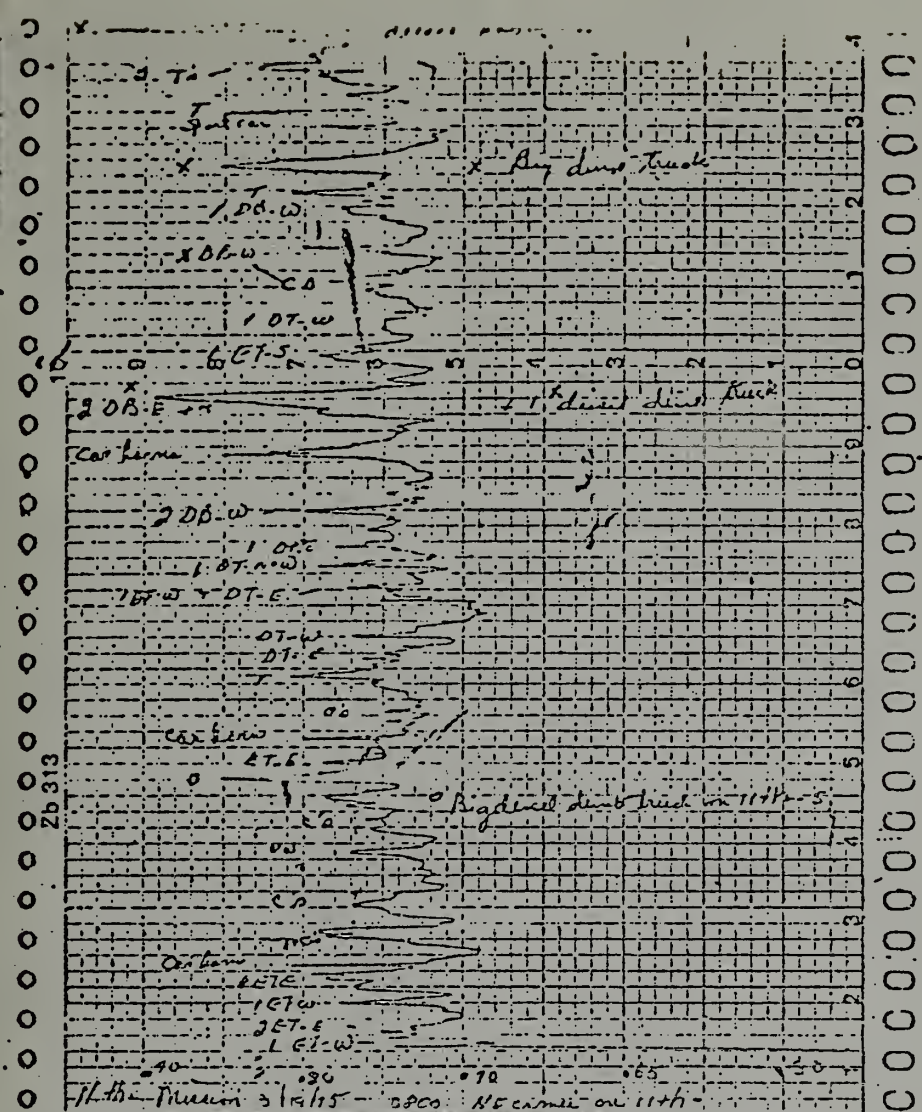
General Radio Sound Level Meter, Class I, Model #1922, serial #1203, Calibrated at time of survey to 124 dbA.

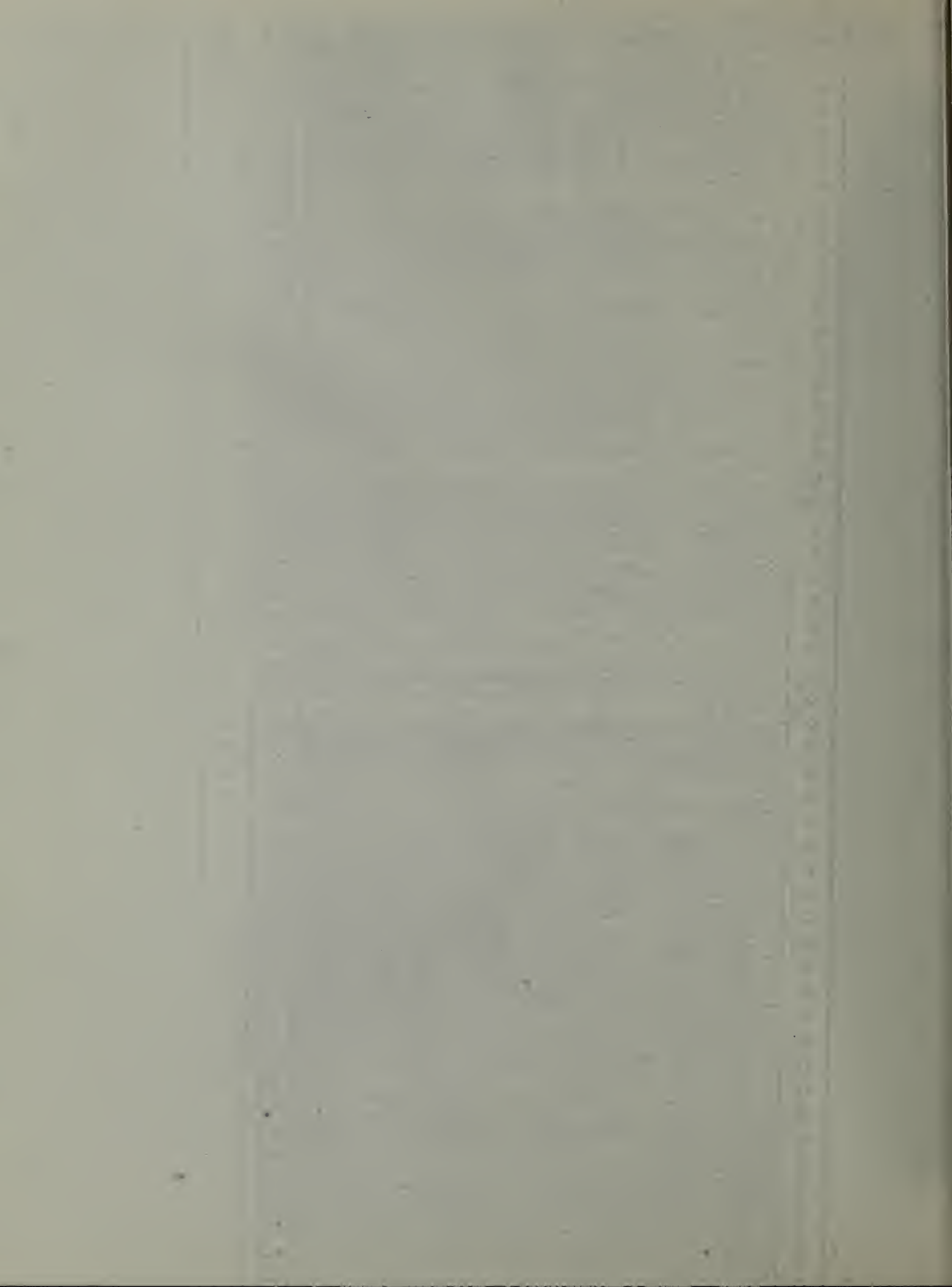
Simpson Linear Recorder, Model #2745, Serial #2010. Tape range calibrated to Meter at time of survey. Meter range 60-80 dbA - Recorder range 10-100 dbA.

Microphone - General Radio, 1/2", multidirectional. Placed on stand, 7' above ground above roof of mobile unit (Rebel Station wagon).

Locations: Nearest safe parking area to roadway. Locations indicated on Simpson tapes appended hereto.







Appendix C:

Civic Center Passenger Counts

Percentage Change in Loadings at Civic Center (Peak Hour)

5-McAllister

1-9-74

4:30-5:30 PM/OUTBOUND

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
<u>Run No.</u>	<u>Load Arr.</u>	<u>Load Dep.</u>	<u>c-b</u>	<u>d-c</u>
	<u>Jones</u>	<u>Poik</u>		
7	56	78	22	
28	55	35	30	
10	63	65	2	
31	56	74	18	
8	17	60	43	
25	35	51	16	
13	53	68	15	
11	59	64	25	
17	37	53	16	
12	35	29	(-4)	
9+34	15	15	0	
14	32	32	0	
19	54	53	(-1)	
20	42	38	(-4)	
15	22	32	10	
16	34	30	(-4)	
	645	627	182	.220

average 22%

5 McAllister

3-25-75

4:30-5:30 PM/OUTBOUND

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
<u>Run No.</u>	<u>Load Arr.</u>	<u>Load Dep.</u>	<u>c-b</u>	<u>$\frac{e}{c}$</u>
	<u>Jones</u>	<u>Van Ness</u>		
23	47	78	31	
7	42	59	17	
28	63	79	15	
10	89	90	1	
29	47	68	41	
31	76	90	14	
25	70	100	30	
11	69	90	21	
17	42	95	53	
9-34	56	92	36	
14	52	85	33	
19	63	64	1	
18	43	46	3	
20	56	74	18	
15	49	50	1	
16	19	56	17	
	885	1217	332	.272

average 27%

21-Hayes

7-25-74 4:30-5:30 PM/OUTBOUND

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
<u>Run No.</u>	<u>Load Arr.</u>	<u>Load Dep.</u>	<u>c-b</u>	<u>$\frac{d}{c}$</u>
	<u>Jones</u>	<u>Van Ness</u>		
23	45	78	33	
11	37	61	24	
5/24	18	29	11	
10	41	55	14	
22	53	58	5	
12	61	45	(-16)	
7	41	40	(-1)	
14	65	90	25	
18	42	40	(-2)	
8	14	19	5	
17	42	35	(-7)	
19	19	62	43	
9	11	22	11	
	489	634	145	.228

average 23%

21-Hayes

7-30-74

4:30-5:30 PM/OUTBOUND

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
<u>Run No.</u>	<u>Load Arr.</u>	<u>Load Dep.</u>	<u>c-b</u>	<u>$\frac{d}{c}$</u>
	<u>Jones</u>	<u>Van Ness</u>		
23	13	65	52	
11	19	36	17	
5/24	40	69	29	
13	47	57	10	
10	45	68	23	
22	43	63	20	
12	22	27	5	
7	43	29	(-14)	
14	61	72	11	
18	60	65	5	
17	29	28	(- 1)	
8	48	53	5	
19	44	41	(- 3)	
16	62	67	5	
15	37	42	5	
9	10	21	11	
	623	803	180	.224

average 22%

Summary of Observations--All 4:30-5:30 PM/OUTBOUND

<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
<u>Route</u>	<u>Date</u>	<u>Load at</u> <u>Van Ness (Polk)</u>	<u>Civic</u> <u>Center</u> <u>Psgrs.</u>	<u>d</u> <u>c</u>
5	1-9-74	627	182	.220
5	3-25-74	1217	332	.272
21	7-25-74	634	145	.228
21	7-30-74	803	180	.224
		3481	839	.241

average 24%

Appendix D:

Present Value of the Cost of Placing an Additional
Vehicle in Service for a 20-year Operating Period

The present value of the cost of placing one vehicle in service for a 20-year operating period (assuming \$45,000 operating cost per year, initially, 6% inflation and a 6½% interest rate).

<u>Year</u>	<u>Actual Cost</u> (increasing at 6% per annum)	<u>Present Value</u> (at 6½% interest rate)
1	\$ 45,000	\$ 45,000
2	47,700	44,789
3	50,562	44,578
4	53,596	44,369
5	56,811	44,161
6	60,220	43,954
7	63,833	43,747
8	67,665	43,542
9	71,725	43,337
10	76,027	43,134
11	80,588	42,931
12	85,423	42,730
13	90,549	42,529
14	95,982	42,330
15	101,741	42,131
16	107,845	41,933
17	114,316	41,736
18	121,175	41,540
19	128,445	41,345
20	136,152	41,151

TOTAL: \$860,967

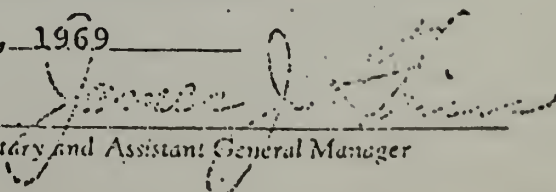
Appendix E:

FUC Resolution No. 69-0828

RESOLVED, That the General Manager of Public Utilities and the Commission's staff are directed to conduct their efforts to improve the Municipal Railway in such manner so as to optimize the use of the City's electrical facilities and electrical transit equipment thereby placing emphasis on electric-powered transit in San Francisco with a resulting reduction in pollution of the environment by poisoning of the air and a rising level of objectionable noise which is produced by motor coaches.

RESOLUTION NO. 69-0828

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission
at its meeting of _____ November 25, 1969 _____


Secretary and Assistant General Manager

Appendix F:

Letter of March 8, 1972 from Mr. Jack M. Barron

To Mr. Robert Dolan, Clerk of the Board of Supervisors



Joint Com. + 241
CITY AND COUNTY OF SAN FRANCISCO
TRANSIT TASK FORCE

OFFICE OF THE
PROJECT MANAGER

1972 MAR 14 PM 1:00
March 8, 1972

cc see last page
1182 MARKET STREET, SUITE 422
SAN FRANCISCO, CALIFORNIA 94102
558-3757

137-71-11

Mr. Robert Dolan
Clerk of the Board
Board of Supervisors
235 City Hall
San Francisco, CA 94102

Dear Mr. Dolan:

On January 12, 1972 we presented a Schematic Plan for the Reconstruction and Beautification of Upper Market Street from the Central Freeway crossing to the vicinity of Diamond Street to a Joint Committee composed of members of the Finance Committee and the Streets and Transportation Committee. This Schematic Plan was developed in accordance with Board of Supervisors Resolution No. 849-69 dated December 20, 1969 that declared as official policy that sidewalk widths on this section of Market Street be in general 15 feet, except at entrances to underground transit stations and certain other areas where required to accommodate amenities, in which instances sidewalks widths shall be 24 feet. The Resolution further directed the preparation of such Schematic Plans be based upon this policy and upon the concept that it is desirable to harmonize the general character of the full length of Market Street.

At the close of the Joint Committee public hearing, the Chairman posed a series of questions which are listed with related answers as follows:

A. Question: What is the feasibility of revising the policy on eliminating overhead wires on Lower Market Street?

There are several major problems in retaining the trolley coaches:

Firstly and most important is the esthetic consideration which was the main selling point of the Market Street Bond Issue. The existing street is a clutter of signs, wires and disrelated street equipment forming an ugly and unappealing element. With a new sign ordinance already in effect, plus the new street equipment designs, the retention of Muni trolley wires and their required support poles will return the very ugliness, clutter and disarray, the Bond Issue was striving to eliminate.

Secondly, the entire trolley underground electrical distribution system would have to be replaced. Aside from the fact that this is an unanticipated expenditure by S.F. Muni Railway, it will take from 6 to 8 months from the time official notice is given to proceed and funds provided to complete the design and award a contract for the work plus another 6 to 8 months to complete construction. As portions of this work would be done under the brick sidewalk as well as under the roadway, brick sidewalk reconstruction presently underway would have to be delayed to accommodate under sidewalk conduit

Mr. Robert Dolan
Clerk of the Board

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March 8, 1972

installations and to resolve the problems caused by having 2 contractors doing conflicting work in the same area.

Thirdly, there will be a direct conflict between the combined traffic signal and sign standards and the coach trolleys.

Since we are attempting to give order and visibility to traffic signs, it has been deemed necessary that the traffic signal and signs be suspended over the roadway of Market Street in order to be visible. Therefore, to resolve this conflict between the standards and the trolley coach, the standards will have to be redesigned. At present, while we do not know what the solution would be, we estimate that it will take 4 to 6 months to complete the redesign. The redesign, we believe, would require erecting support poles in new locations with attendant new location of underground electrical conduit. This in turn may necessitate relocating other Street Equipment with its attendant underground electrical conduit. The overall result being that we would have to delay laying of any brick until these problems were resolved.

Lastly, but of a more minor nature are the existing foundations for the "Path of Gold" poles which are not designed to withstand the additional forces that would result from installation of a trolley wire system. The resultant change in existing contracts for modification of the pole foundations may delay somewhat the finish of the work.

The reconstruction presently underway between 5th and 7th Streets and the work scheduled to be started in April, 1972 between 5th and Fremont Streets represent about 50% of the work to be

Mr. Robert Dolan
Clerk of the Board

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March 8, 1972

done for the entire project in the sidewalk area. Should trolley coaches remain on Market Street, this half of the work would be delayed by several months.

Based on the foregoing, it is impractical to retain the trolley wires on Market Street since it would result in an additional cost to the City of at least \$1,000,000 for replacing the electrical distribution system, for altering design and locations of signal and sign standards, for redesigning costs, for delaying existing construction contracts and for delaying the award of future contracts from 6 to 9 months while awaiting the completion and approval of design and redesign. In addition to these costs, we should also remember that the property owners, tenants, and general public which have already experienced great inconvenience with BART construction would be exposed to additional months of inconvenience.

B. Question: What is the feasibility of increasing sidewalk widths by 6' on each side of Market Street in order to accommodate bicycle lanes? (Question is based on the assumption of 4 moving traffic lanes).

In discussions held with the San Francisco Bicycle Coalition representatives, it is our understanding that the cyclist desires bike paths between the trees and the private property line of Market Street. These paths would require a wider sidewalk

Mr. Robert Dolan
Clerk of the Board

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(presumably 6' wider) and a change in the proposed relocation of trees, lights, furniture and other equipment. To accomplish this change in design would require redesign of the completed proposed Schematic Design. Apparently, the cyclists desire these paths be at the same level as the sidewalk or in an area, slightly depressed, with very gently sloping sides. If the path is depressed, a tripping situation would result and proper drainage of the sidewalk will be destroyed and a more costly method of drainage would have to be devised.

We believe that any bike path within the sidewalk area will be dangerous to pedestrians, the handicapped and blind people, because should a cyclist lose control of his bike or is negligent in watching where he is going, he can very easily crash into pedestrians. Further at intersections, pedestrians waiting to use the crosswalks, bus patrons boarding and alighting from buses will be endangered by cyclists. According to the City Attorney's Office, the City could be legally liable for any injuries sustained by pedestrians, handicapped or blind persons, as a result of having bike paths in the sidewalk.

Considering that Upper Market Street has no beginning and no ending for a cyclist, the danger to bus patrons, pedestrians, handicapped and blind persons and the possible liability the City may incur from pedestrian and cyclist injuries, we do not think it feasible nor safe to widen the sidewalk to

accommodate bicycle paths.

- C. Question: What is the feasibility of placing bike paths in the median? (Question based on the assumption of 4 moving lanes of traffic).

Bike paths in a median strip are possible on either a permanent or temporary basis.

- D. Question: What is the most feasible manner of connecting bike lanes in Upper Market to Lower Market Street?

Lower Market Street between Embarcadero Plaza and Franklin Street is basically a 4 lane street with 9' loading and parking bays. Because emergency vehicles, buses, taxis, autos and trucks all have to be accommodated, it is impossible to have less than 4 moving lanes and consequently, separate bike lanes cannot be accommodated in the roadway area. Since the sidewalks contain a good number of subway entrances, large amounts of street furniture and street equipment plus large volumes of pedestrians; bike paths cannot be accommodated on the sidewalks. In the remaining portion of Lower Market Street between Franklin Street and the Central Freeway, a heavy flow of traffic across Market Street between Valencia and Guerrero and the one-way couplet of Franklin and Gough Streets exists, resulting in a heavily congested situation. With this in mind, it is highly undesirable and dangerous to attempt to operate bicycles in the area. In short, it is undesirable and dangerous to use bicycles in the Lower Market

Mr. Robert Dolan
Clerk of the Board

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March 8, 1972

Street area between Embarcadero Plaza and the Central Freeway overpass. Consequently, there is no feasible way to connect bike lanes between Upper and Lower Market Street.

In summary, inasmuch as the present use of bicycles in San Francisco is predominately recreational, and as Upper Market Street is neither a beginning or a terminating point for bicycles and as Upper Market Street is a heavily public transportation oriented Street and as Upper Market Street will not be restored to full usage until 1975, we recommend the following course of action.

- 1) Approve the proposed schematic plan based on the Board of Supervisors Resolution 849-69 that adopted existing City policies for 16' and 24' sidewalk widths.
- 2) The Department of Public Works along with the Department of City Planning and other City Agencies, investigate the present and projected use of bicycles in San Francisco. Prepare a plan, based upon this investigation, to show the recommended location of bike lanes taking into account such factors as topography, projected demand and public transit operations. This investigation and planning could be done at an approximate cost of \$10,000.00.
- 3) After completion of the above investigation, the Board of Supervisors conduct appropriate hearings to evaluate the report.

E. Question: Feasibility of replacing median with left-turn lane.

It is feasible to provide a left-turn lane in median if median is at least 10' wide.

F. Question: Who has the legal jurisdiction to determine the type of street trees used on the street and if they are other than the London plane trees recommended, what are the problems?

The City Attorney's office has determined that the Board of Supervisors does not have the legal jurisdiction to determine the type of trees planted on the street. The selection of the trees is under the legal jurisdiction of the Chief Administrative Officer and the Director of Public Works.

Inasmuch as the Board of Supervisors has a public hearing scheduled for March 1, 1972 on the use of sycamores for Upper Market Street, this letter will not attempt to justify its appropriate use now, but, rather outline the ramifications that would result if another tree were to be chosen.

With Market Street beginning at the Embarcadero Plaza and extending to the foot of Twin Peaks, the greatest desire of the design architects and many of the residents of Upper Market Street area is that for Market Street to become a grand street, it must have uniformity, continuity, and a consistent character along its entire length. The Task Force shares this desire and very strongly believes that the street should be

visually and esthetically related throughout its length and not be sub-divided into two non-related sections. In order to retain uniformity along the entire street and to have the feeling and appearance of one grand street, it is important to continue the major elements of design, namely: the brick sidewalks and crosswalks, the street trees, and the "Path of Gold" Lights. Should a different tree be used on Upper Market Street, the street uniformity, continuity and scale would be destroyed and Market Street would then assume two different and dissimilar characters within its length.

Since the basic tree spacing and related items such as street furniture, street equipment, Muni Subway transit entrances, lighting, etc. were laid out on a spacing sympathetic to and requiring the size and scale of the London plane tree, substitution of another tree would require at an additional cost, some redesign of the existing schematic plan.

With the development of Market Street into a grand boulevard along its entire length, it must be remembered that the major 3 dimensional factor accomplishing this grandness is the street trees which should be unbroken and consistent in type and size along the Street's entire length.

G. Question: What would be the cost of completing Preliminary designs for Upper Market Street for those areas outside the station's areas at Castro

and Church Streets?

If the proposed Schematic Design Plan is adopted, preliminary design services to complete the above area would be at least \$50,000.

H. Question: What is the estimated cost to the City for purchase of the ARCO Station at Castro & Market Streets?

The acquisition cost of the ARCO Station property at the northwest corner of Market at Castro Streets would be in the range of \$225,000 to \$260,000. In addition to this acquisition design and construction costs may be in the range of \$100,000.00. Even though acquisition is not contemplated in our Schematic Design, a plaza at this location could be incorporated in any subsequent design phase since its inclusion would not alter any of the basic design concepts. It should be noted that while it is generally desirable to have as much area as possible contiguous to Market Street devoted to plazas or parks, we believe that this acquisition would not substantially benefit the area.

I. Question: Can bus stops be relocated closer to Muni Underground transit entrances?

There are only two Muni underground transit stations on Upper Market Street, one at Castro Street and the other at Church Street. At Castro Street Station, the bus loading

Mr. Robert Dolan
Clerk of the Board

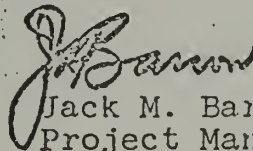
Page 11
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zone on the north side of Market Street is located immediately adjacent to a proposed bus shelter that is approximately 12' from an entrance while the bus loading zone on the south side of Market is located on Castro Street as close to the entrance as possible without forcing the bus to stop in a pedestrian crossing.

At the Church Street Station, the bus loading zone on the north side of Market is approximately 60' from the entrance, thus permitting the bus to stop clear of the pedestrian crosswalk. The bus loading zone on the south side of Market Street is located approximately 30' from the entrance. In general, all the bus loading zones on Upper Market have been located to accommodate the transit patron without causing interference between pedestrian and general traffic movements.

Should the Board desire further information from this office, we will be happy to furnish any items desired.

Very truly yours,



Jack M. Barron
Project Manager

cc: Supervisors Ronald Pelosi, President, Board of Supervisors
John J. Barbagelata
Roger Boas
Dianne Feinstein
Terry A. Francois
Robert E. Gonzales
Quentin L. Kopp
Robert H. Mendelson
John L. Molinari
Peter Tamaras
Dorothy von Beroldingen

Appendix G:

Argument for Proposition A (Market Street Bonds):

Excerpt from Official Voters' Pamphlet for Election of

June 4, 1968

Read Second Time and Finally Passed—Board of Supervisors, San Francisco, March 25, 1968.

Ayes: Supervisors Blake, Boas, Ertola, Francols, Mailliard, McCarthy, Mendelsohn, Morrison, Pelosi, Tamaris, von Beroldingen.

I hereby certify that the foregoing ordinance was finally passed by the Board of Supervisors of the City and County of San Francisco.

ROBERT J. DOLAN, Clerk

Approved: April 3, 1968.

JOSEPH L. ALIOTO, Mayor

PROPOSITION A

Market Street Reconstruction and Improvement Bonds, 1968. To incur a bonded indebtedness of \$24,500,000.00 for the reconstruction and improvement of Market Street, of portions of streets intersecting Market Street and of street areas in the vicinity of transit stations.

ARGUMENT FOR PROPOSITION "A"

Vote Yes on "A"—A Bold Plan for a Great Street

All of us have wondered when something would be done about Market Street.

Proposition A—a bold plan for a great street—is the answer!

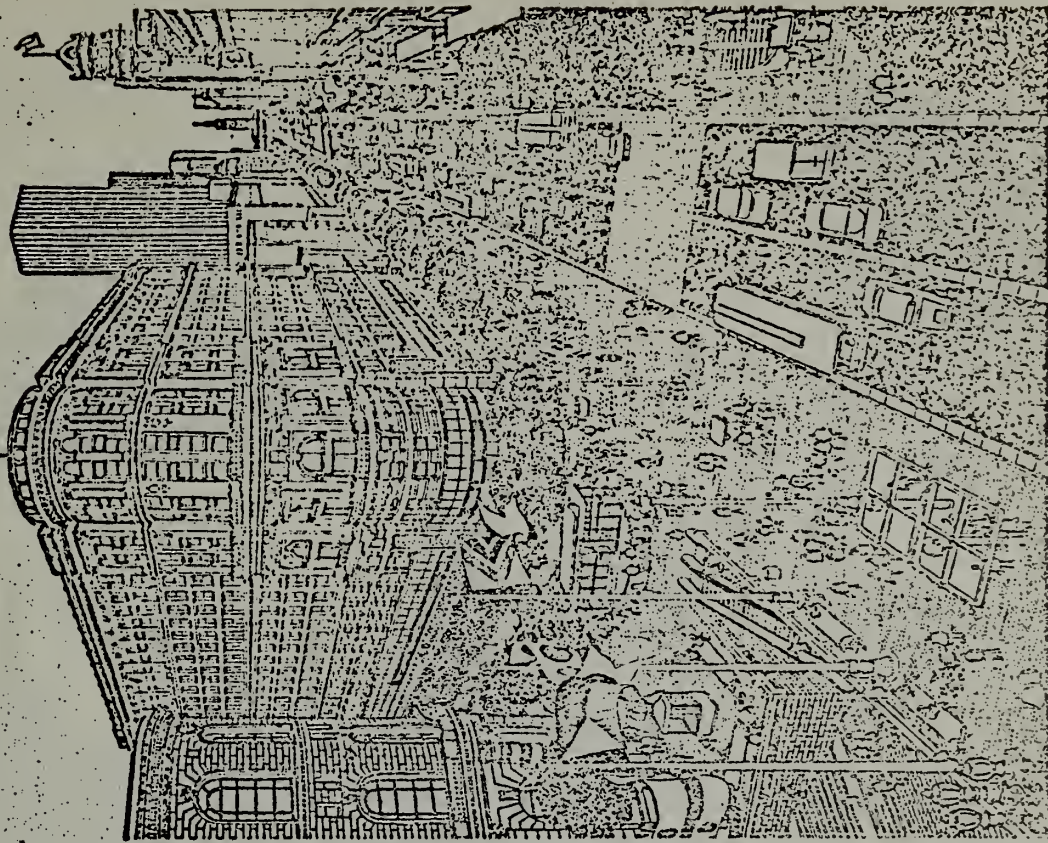
Market Street has been torn up and laid open for construction of the new subway. Soon that subway work will be completed and at that time San Francisco must either put Market Street back the way it was—dreary, depressing and uninviting—or we can seize a once-in-a-lifetime opportunity and transform it into a truly great street, a magnificent boulevard that will be as important to the economy and reputation of the City as was the Market Street of years ago.

Traditionally, Market Street has divided San Francisco. Proposition A, together with the extension of both Fifth Street and Seventh Street across Market will at last bring North and South of Market Street together. From the Ferry Building to Valencia Street, this handsome new thoroughfare will attract pedestrians, encourage retail activity and provide a park-like environment for all San Franciscans—workers, shoppers and visitors.

The drawing on the next page reveals the exciting new Market Street design with its broad sidewalks, distinctive paving, large trees and spacious plazas.

Vote Yes on "A"—\$9,900,000 Already Available

The total cost of the Market Street reconstruction and neighborhood station improvements is \$34,400,000. The City already has \$9,000,000 from Federal Grants, approved bonds and State Gas Tax funds available for this project. Nearly one-third of the Market Street project is already financed. Your Yes vote will provide the remaining \$24,500,000.



Proposition "A" Will Give San Francisco a New Market Street

Vote Yes on "A"—What It Provides

Proposition A will provide the wide sidewalks and dramatic landscaping for Market Street, the refurbishing of the Path of Gold light standards, the installation of benches, tree guards, street furniture, and the distinctive sidewalk paving.

The majestic Civic Center will be connected to Market Street through a new Fulton Mall.

Great new public plazas will be constructed at Powell Street and Civic Center.

In addition, Proposition A will provide for roadway paving, relocation of police and fire call boxes, necessary sewer work, relocation of high pressure fire hydrants and mains, and provision of new traffic signals and signs.

The new Street will have four rather than six lanes of moving traffic. In the absence of surface streetcars, Market Street will have a greater vehicle capacity. The 35-foot sidewalks are interrupted where necessary with parking bays for truck loading and right turn lanes to keep the flow of traffic moving.

Significantly, Proposition A provides funds for the surface improvement of the transit stations along the Mission Line and the Upper Market Line. These stations will be consistent in appearance with those on Market Street.

Vote Yes on "A"—Jobs!

The reconstruction of Market Street and the neighborhood transit stations means jobs. Not only jobs in the construction trades but, when the work is completed, additional jobs from increased business activity throughout the City.

Vote Yes on "A"—A Good Investment for You

Proposition A is a sound investment for everyone in San Francisco. A revitalized Market Street will greatly stimulate retail activity. San Francisco with its ready accessibility via rapid transit from outlying communities will be a magnet for shoppers.

Tourists and visitors, now the number one industry in San Francisco, will be drawn by Market Street and pour fresh dollars into our economy. Increased retail activity will bring to the City added sales tax revenues. Most important, a strong central business district with an expanding tax base will help take the tax pressure off home owners and renters. The experience of other large cities proves that if the Central Business District declines, neighborhood taxes rise.

Vote Yes on "A"—The Future Is Now

Rarely does a city have an opportunity to transform its appearance on the scale offered San Francisco through Proposition A. San Francisco had such a chance after the 1906 catastrophe and missed. Market Street began to decline in the 1930's.

The voters approval of the Rapid Transit Bonds in 1962 marked a turning point. Major construction in the downtown area was virtually nonexistent for thirty years. Since passage of the rapid transit bonds, however, many of these areas have started to boom. The new Wells Fargo, Standard Oil, Crocker, Citizens Federal and Fox Plaza Buildings attest to this vitality. The first new major retail store in twenty years is now under construction on the south side of Market Street.

Now is the opportunity to make certain that we gain the greatest possible advantage from rapid transit construction. Aside from scaring costs, San Francisco would never tolerate a second total disruption of Market Street.

Vote Yes on "A"—A Symbol of San Francisco's Vitality

San Francisco is traditionally a great City. We know it and so does the world. In recent years, San Francisco's leadership in the Bay Area has been challenged in many areas. Neighboring communities have formed symphonies and built museums, major league sports have located outside the City, the Port of San Francisco faces stiff competition. Renewed interest is springing up in America's central cities. Across the land, cities are rebuilding. St. Louis has built a magnificent arch along the Mississippi River symbolizing its regeneration. New York has placed the glittering Lincoln Center in a former slum, Los Angeles is justly proud of its Music Center and new Downtown, Oakland has financed its Sports and Convention Center. San Francisco's opportunity to undertake a great project symbolizing our faith in ourselves is the creation of a truly great thoroughfare along the length of Market Street. In eight years, San Francisco will mark its two hundred year anniversary. Market Street reconstruction is a fitting beginning to the next hundred years. The future is now! Now is the time for greatness.

Vote Yes on A!

Proposition "A" has been endorsed by the following:

Alamo Square Association
Apartment House Associations Consolidated
Building Owners and Managers Association of San Francisco

California Northern Hotel Association
California Society of Professional Engineers

Chinese American Citizens Alliance
City Planning Commission of San Francisco

Down Town Association of San Francisco
Greater San Francisco Chamber of Commerce

Market Street Development Project
Northern California Chapter-American Institute of Architects

San Francisco Beautiful
San Francisco Building and Construction Trades Council

San Francisco Joint ILWU Legislative Committee
San Francisco Labor Council AFL-CIO

San Francisco Street Planning Advisory Committee
Honorable Joseph L. Alioto,

Mayor of San Francisco

Frank N. Alioto

Edward A. Barry

Richard A. Bancroft

Reverend George L. Bedford

S. Clark Beise

Peter Berout

A. Brooks Berlin

Morris Bernstein

James B. Black, Jr.

Ben Blumenthal

John S. Bolles

Reverend Hamilton T. Boswell

Matthew J. Boxer

Harry Bridges

Henry J. Budde

F. Campagnoli

Caroline Charles

William H. Chester

George T. Choppelas

Honorable George Christoforber

William P. Clecak

Wm. Hunt Conrad

Ransom M. Cook

Sheldon G. Cooper

Charles Crocker, III

John F. Crowley

Margaret Cruz

Madlyn Day

Daniel F. Del Carlo

Charles de Limur

Adolfo de Urioste

John Walton Dinkelspiel

Joseph J. Diviny

Don Fackertley

Thomas E. Feeney

Dianna Feinstein

Elmo E. Ferrari

John P. Figone, Jr.

Mortimer Fleishacker, Jr.

Herman E. Gallegos

Louis Garcia

Robert H. Gordes

Richard N. Goldman

Robert E. Gonzales

Lucretia del Valle Grady

Walter A. Haas, Jr.

Gregory A. Harrison

Marco F. Hellman

Paul E. Hoover

David Jenkins

George IV. Johns

Vernon Kaufman

Roger Kent

William Kent III

William H. Kilpatrick
J. Rufus Kilavans
Daniel R. Keshland
Ted James Kukula
Stephen C. Leonoudakis
Francis Louie
Robert Lurie
Louis R. Lurie
Cyril Magnin
J. W. Mailliard III
William M. Malone
Thomas A. Maloney
Alan S. Maremont
Joseph Martin, Jr.
Anita G. Martinez
Joseph P. Mazzola
William E. McDonnell
Garret McEnerney II
Thomas J. Mellon, Chf. Admin. Off. and
Chairman, Capital Improvement
Advisory Committee

J. M. Menzies
Wilson Meyer
Bishop C. Kilmer Myers
Terence J. O'Sullivan
Frank L. Paganini
Mrs. Charles B. Porter
John H. Riordan
James J. Rudden
Albert E. Schlesinger
Honorable John F. Shelley
Walter H. Shorenstein
Robert E. Sinton
Ferdinand R. Stent
Jerd Sullivan, Jr.
James F. Thatcher
Timothy J. Twomey
Stephen Walter
Osceola Washington
E. Hornsby Wasson
Harold L. Zellerbach

On April 15, 1968, the Board of Supervisors authorized the foregoing argument for inclusion in the election pamphlet of June 4, 1968, by the following vote:
Ayes: Supervisors Blake, Boas, Ertola, Francois, Mailliard, McCarthy, Mendelsohn, Morrison, Pelosi, Tamaras, von Beroldingen.
ROBERT J. DOLAN, Clerk

CITY AND COUNTY OF SAN FRANCISCO
OFFICE OF THE CONTROLLER
CONTROLLER'S STATEMENT PURSUANT TO CHARTER SECTION 183
PROPOSITION "A"

Market Street Reconstruction and Improvement Bonds, 1963. To incur a bonded indebtedness of \$24,500,000 for the reconstruction and improvement of Market Street, of portions of streets intersecting Market Street and of street areas in the vicinity of transit stations.

Should the proposed bond issue be authorized and when all bonds shall have been issued on a fifteen year basis, and after consideration of the interest rates related to current municipal bond sales and using the 1967-1968 assessment roll as the basis for calculating the effect upon the tax rate, in my opinion, it is estimated that approximate costs would be as follows:

Bond Redemption	\$24,500,000
Interest Requirement	8,820,000
Total Debt Service Requirement	\$33,320,000
Average annual debt service requirement for fifteen years	\$ 2,221,333
Based on a report submitted by the Transit Task Force, the annual increase in maintenance cost is estimated to be	90,000
Net annual recurring costs which are equivalent to ten and sixty six hundredths (10.66) cents in the tax rate	\$ 2,311,333

NATHAN E. COOPER, Controller
City and County of San Francisco

Appendix H:

Board of Supervisors' Resolution No. 392-72

Regarding Beautification of Upper Market Street

APPROVING THE SCHEMATIC DESIGN FOR THE RECONSTRUCTION AND BEAUTIFICATION OF UPPER MARKET STREET FROM THE CENTRAL FREEWAY CROSSING TO THE VICINITY OF DIAMOND STREET CALLING FOR THE PLANNING OF PROTECTED BICYCLE LANES AND RECOMMENDING-NECESSARY PRELIMINARY DESIGN PLANS BE PREPARED AND FINANCED FROM GAS TAX FUNDS.

WHEREAS, The Board of Supervisors of the City and County of San Francisco by Resolution No. 849-69 did declare as official policy that sidewalk width on Upper Market Street from the Central Freeway to the vicinity of Diamond Street (hereinafter referred to as Upper Market Street) be in general 16 feet except at the entrance to underground transit stations and certain other areas where required to accomodate amenities, in which instance sidewalk width shall be 24 feet; and

WHEREAS, Resolution No. 849-69 did authorize the Transit Task Force to engage consultants to prepare schematic design plans for Upper Market Street; and

WHEREAS, The Transit Task Force did subsequently engage a firm of architects, Whisler-Patri Associates (hereinafter referred to as Consultant); and

WHEREAS, These plans reorganized existing neighborhood planning efforts first began in 1964 under auspices of the Upper Market Planning Association (UMPA), with the active assistance of the San Francisco Planning and Urban Renewal Association (SPUR); and

WHEREAS, These plans have also been actively and constructively reviewed by the Eureka Valley Promotion Association, Eureka Valley Merchants Association, Market-Castro-Duboce Property Owner Association, Noe Henry United Community, Buena Vista Neighborhood Association, San Francisco Bicycle Coalition, San Francisco Tomorrow, and other groups, all of whom have made many constructive suggestions and additions; and

WHEREAS, It is the desire of the Board of Supervisors of the City and County of San Francisco to proceed with the reconstruction in vicinity of Transit Stations with the minimum delay and cost and with minimal alteration of the overall pedestrian environment of trees, planting, sidewalk materials, open spaces, and street equipment and furniture as depicted in the plans prepared by the Consultant, but with adequate planning for the incorporation of separated and protected bicycle paths along Upper Market Street when it is reconstructed; and

WHEREAS, Article 6 of the Public Works Code (Chapter X of the Municipal Code) of the City and County of San Francisco does empower the Board of Supervisors of said City and County to fix the widths of all open public streets and invests said Board of Supervisors with jurisdiction to order to be done therein, thereover or thereon, either singly or in combinations, all work necessary or suitable to improve the whole or any portion of said streets; and

WHEREAS, The Board of Supervisors of the City and County of San Francisco by Resolution No. 363-71 did declare City policy in support of bicycle-riding as an everyday means of transportation, calling upon City agencies to take action in accord with that policy; and

WHEREAS, The bicycle-planning element of the Improvement Plan for Transportation, adopted by the City Planning Commission on April 27, 1972 as part of the Master Plan of the City and County of San Francisco, calls for the development of bicycle routes throughout the City, including Upper Market Street as a street on which a bicycle route should be developed; and

WHEREAS, The Vehicle Code (Section 21207) of the State of California permits the establishment of bicycle lanes separated from any vehicular lanes upon City streets; and

WHEREAS, The public convenience would be enhanced by the installation of transit passenger shelters at all transit stops on Upper Market Street, and the aforesaid Improvement Plan for Transportation

does state as one of the "Design Guidelines for Transit Routes" that there should be adjacent space for shelter at major transit transfer locations wherever possible; now, therefore, be it

RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby approve the following schematic design plans and drawings for the reconstruction and beautification of Upper Market Street and other adjacent street areas, as depicted by the Consultant, and copies of which are on file in the office of the Clerk of the Board of Supervisors in File No. 137-71-11, as such plans relate to the design of the sidewalk and curb area only, and subject to provision that adjacent space for shelter at major transfer locations be provided:

1. Schematic Street Design Plan, Drawing TTF-1071.1, showing the street design as to the scale and hierarchy of surface spaces. The tree configuration and the general concepts of the pedestrian environment in design terms of overall pattern of the sidewalk and crosswalk material.
2. Schematic Design in the vicinity of the transit station at Market and Church Street area, Drawing TTF-1071.2, as to the establishment of the general design character of the street intersection of Market, Church, and 14th Streets and its relationship to the Municipal Railway subway entrances, tree configuration, the Municipal Railway track alignment on Church Street, and the scale and overall pattern of street and sidewalk.
3. Schematic Design in the vicinity of the transit station at Market and Castro Streets, Drawing TTF-1071.4, as to establishment of the general design character of the street intersection of Market, Castro and 17th Streets and its relationship to Municipal Railway subway entrances, tree configuration, sculpture location and scale and overall pattern of street and sidewalk.
4. Schematic Design of Street Equipment and Furniture, Drawing TTF-1071.6, a set of 16 drawings as to the establishment of the general character of the overall design of the street furniture and equipment, subject to more detailed study of individual components and be it

FURTHER RESOLVED, That the Board of Supervisors does hereby request the Transit Task Force to prepare, or to engage a consultant to prepare plans that provide bicycle lanes on each side of the street /between the parking lane and the sidewalk by the earliest possible date, such lanes of a minimum width of six feet and separated from pedestrian and all automotive vehicles, whether moving or parked, by an adequately wide, effective and permanent separation, and to further provide for four lanes of vehicular traffic (two lanes easterly and two lanes westerly), with a landscaped median strip allowing for left-hand turn provisions, and to submit such plans to the Board of Supervisors for its consideration; and be it

FURTHER RESOLVED, That to implement the schematic design and plans and drawings for the restoration and beautification of Upper Market Street and other adjacent street areas, the Board of Supervisors of the City and County of San Francisco does hereby declare as a matter of policy that it is its intention to:

1. Plan bicycle lanes on Upper Market Street.
2. Close Collingwood Street to vehicular traffic between Market and 17th Streets.
3. Make 17th Street on the north side of Market Street one-way westbound to Diamond Street, and 17th Street on the south side of Market Street one-way eastbound to Noe Street.
4. Encourage elimination of private driveways to property from Upper Market Street.
5. Adopt as a matter of City policy the following utility criteria for Upper Market Street restoration and beautification:
 - a. All new utility main systems to be installed in BARTD's rapid transit system areas shall be placed in the roadway.
 - b. Utility main systems presently located in the sidewalk area and in direct conflict with the proposed tree planting project shall be moved; however, utility main systems not in direct conflict with the tree planting project and for which no disruption of the sidewalk for future maintenance or repair of the utility facility is likely, may remain in place in the sidewalk area.

c. Transformer vaults, because of their size and nature, may remain in the subsidewalk area and installation of future transformer vaults in the sidewalk area may be permitted.

d. All utility conflicts which may arise in connection with the implementation of this policy shall be resolved by the Director of Public Works.

6. Require the removal of any existing skylights or elevators in the sidewalk, and not permit construction of any future skylights or elevators in the sidewalk.

7. Not permit location of transit subway vent surface grills in sidewalks or pedestrian crosswalk areas.

8. Require that property owners presently occupying subsidewalk space modify such space when requested in connection with the restoration and beautification of Upper Market Street, or else vacate and remove privately owned facilities; such as structures, equipment, etc.

9. Avoid plans for transit vehicle use of Upper Market Street which would require utilization of overhead trolley wires on Lower Market Street.

FURTHER RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby recommend that the necessary design plans be prepared in order to develop information necessary for coordination of BARTD construction, utility construction, and private development; such design plans to be financed from Gas Tax Funds to the extent legally possible.

Appendix I:

Transit Passenger Destinations

In the Downtown Area

Table 1

Transit Trip Interchange in Trolley Coach Catchment Area

Home Based Work Trips

Origin Zone	Destination	Percent North of Market (Zones 2, 3, 40)	Percent Between Market and Howard (Zone 39)	Percent South of Howard (Zone 1)	Total Trips, Zones 1, 2, 3 39, 40
21		59.0	25.0	16.0	4268
22		58.0	30.0	12.0	4357
23		54.3	29.4	16.3	2660
27		64.7	23.0	12.3	3880
29		65.7	23.3	11.0	2382
30		63.7	26.3	10.0	2481
32		60.8	23.4	15.8	2752
TOTAL		60.6	25.8	13.4	22767

Source: BATS; De Leuw, Cather & Company

Table 2

Transit Trip Interchange in Trolley Coach Catchment Area

Home Based Other Trips

Origin Zone	Destination	Percent North of Market (Zones 2, 3, 40)	Percent Between Market and Howard (Zone 39)	Percent South of Howard (Zone 1)	Total Trips, Zones 1, 2, 3 39, 40
21		71.5	19.2	9.3	1681
22		80.6	14.8	4.6	2692
23		69.4	26.1	4.5	1880
27		75.4	19.7	4.9	1707
29		69.0	27.2	3.8	1175
30		75.7	19.9	4.4	822
32		78.1	18.9	3.0	829
TOTAL		74.5	20.2	5.1	10786

Source: BATS; De Leuw, Cather & Company

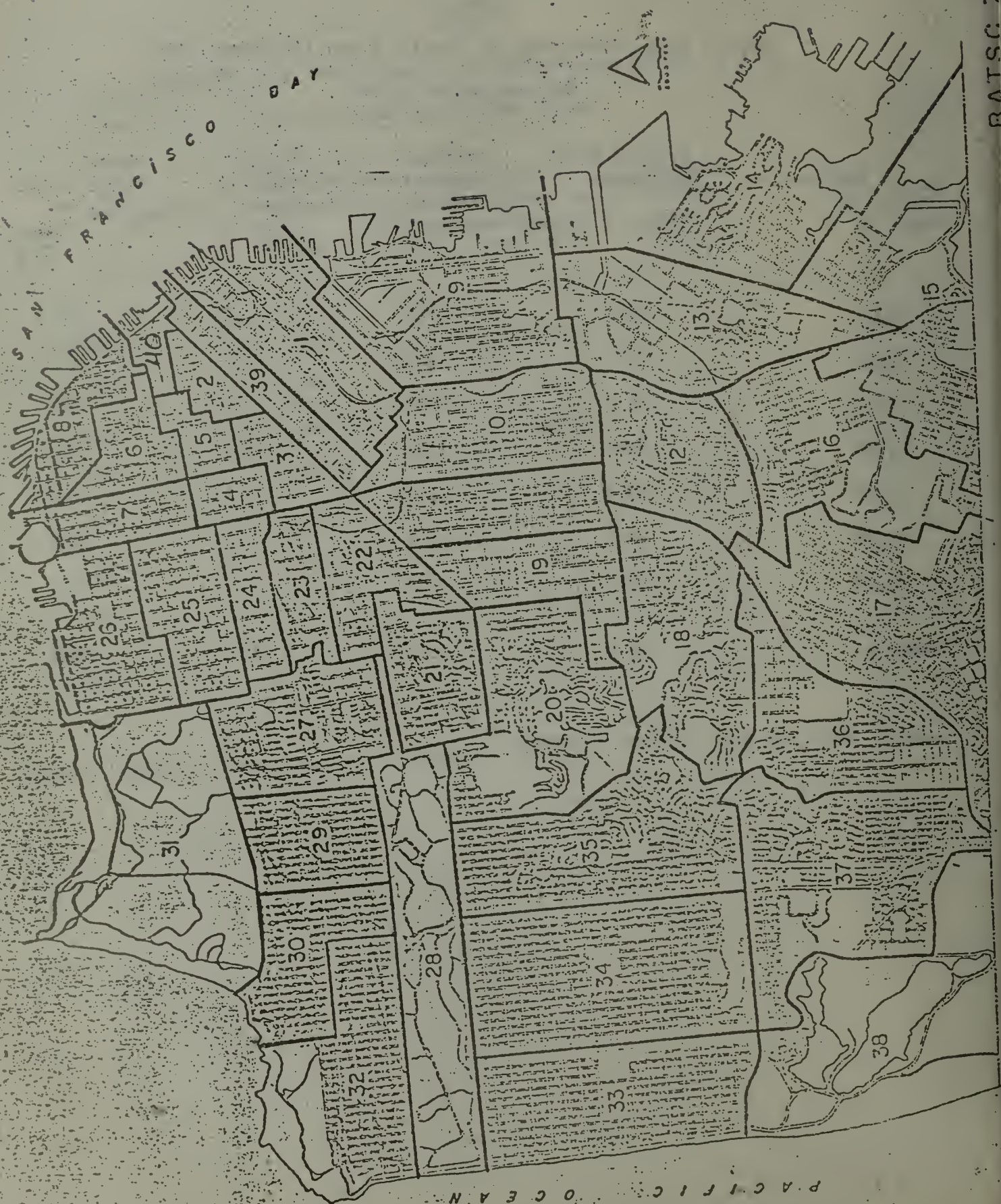
Table 3

Transit Trip Interchange in Trolley Coach Catchment Area

Non-Home Based Trips

Origin Zone	Destination	Percent North of Market (Zones 2, 3, 40)	Percent Between Market and Howard (Zone 39)	Percent South of Howard (Zone 1)	Total Trips, Zones 1, 2, 3 39, 40
21		75.5	17.9	6.6	212
22		74.5	19.8	5.7	494
23		71.9	23.1	5.0	358
27		74.4	19.8	5.8	342
29		80.3	15.3	4.4	183
30		80.2	15.8	4.0	101
32		89.8	8.4	1.8	167
TOTAL		75.9	18.8	5.2	2357

Source: BATS; De Leuw, Cather & Company



Appendix J:

Board of Supervisors Resolution No. 116-68

Regarding Design of Market Street

116-68

APPROVING MARKET STREET DESIGN STUDY OF SCHEMATIC STREET DESIGN, POWELL STREET AND CIVIC CENTER PLAZA DESIGNS; FAVORING A BOND ISSUE TO FINANCE PROJECT; AND RECOMMENDING PREPARATION OF PRELIMINARY DESIGN PLANS FOR THE RESTORATION OF THE SURFACE OF MARKET STREET AND FOR THE ADJACENT PLAZA AREAS.

RESOLUTION NO. 116-68

WHEREAS, The Board of Supervisors of the City and County of San Francisco, by its Resolution No. 662-66, dated September 26, 1966, did establish the basic operational policy for Market Street by approving the City's Urban Design Consultants' plan for four (4) moving lanes of traffic with a basic roadway width of fifty feet (50') with sidewalks thirty-five feet (35') wide throughout the full length of BARTD's subway station areas and, where necessary, at points, twenty-six feet (26') wide to allow for loading bays and existing vehicular traffic and did request that all implementing action consonant with said approval be taken; and

WHEREAS, This policy has subsequently been translated into the schematic design plans for the restoration of the surface of Market Street and for two adjacent plaza areas (at BARTD's Civic Center and Powell Street subway stations) by the City's Urban Design Consultants; and

WHEREAS, The schematic design plans to depict the three major aspects of design: (1) the overall environment, of trees, planting, sidewalk materials, and open spaces; (2) the functional characteristic of roadway design and curb alignments; (3) kiosks, street equipment and furniture; and

WHEREAS, The schematic design plans have been critically reviewed by the staffs of interested and affected City departments, including the Redevelopment Agency; and

WHEREAS, The schematic design plans have been critically reviewed by the Art Commission, the City Planning Commission, the Public Utilities Commission, and the Mayor, and subsequently approved by each of them; and

WHEREAS, The comments and recommendations made in these reviews have been largely of an operational nature which have been incorporated in the schematic plan or will be further studied in the subsequent preliminary plan to stage; and

WHEREAS, Approval by the Board of Supervisors of the City and County of San Francisco of these schematic design plans is essential in order to proceed into the final phases of preliminary and construction documents; and

WHEREAS, To implement the schematic design plans for restoration of the surface of Market Street and for the adjacent plaza areas, certain public policies and actions must be effected which would involve street closures, street improvements, service and delivery considerations, utilities relocation, transit systems, subway surface superstructures, and street trees; now, therefore, be it

RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby approve the Schematic Design Plan for restoration of the surface of Market Street as depicted by the Consultants on the following plans and drawings:

1. Schematic Street Design Plan, Scale 1" = 50', dated September 12, 1967, as to the establishment of the design concept of the ceremonial way and the functional way, the scale and hierarchy of surface spaces, the general tree massing and configuration, and the general concepts of the pedestrian environment in design terms of overall pattern of the sidewalk material, and the unit paver extending through the crosswalks;

2. Schematic Surface Design and Street Furniture Plan, Scale 1" = 50', dated September 12, 1967, as to the establishment of the tree planting plan, the street equipment location plan, surface materials in terms of area and extent of pattern, and location of street furniture;

3. Schematic Functional and Street Equipment Plan, Scale 1" = 50', dated September 12, 1967, as to the establishment of the functional and operational design of the street in terms of curb assignment, right hand vehicular turning lanes, service and delivery bays, crosswalk design and location, street closures, lane designations, illumination and intersection design, subway entrances and local plans for street equipment;

4. Financial Area—Detail Street Design Sketch A, and Retail Area—Detail Street Design Sketch B, both to Scale 1/2" = 1', and both dated September 12, 1967, as to the establishment of the design character of typical blocks and intersections of the street, in terms of location and design of paving materials and patterns, curbs, gutters, catch basins, crosswalks, lane indicators, street equipment, street furniture, subway entrances and line vents;

5. Street Sections A, B, and C, all to Scale 1/2" = 1', Sections A and B, dated July 18, 1967, and Section C, dated August 22, 1967, as to the establishment of the general three-dimensional character of the street and, particularly, the transverse relationships of tree planting, lamp standards, subway entrances, lane widths, service bay provisions, and tree spacing, shapes, sizes, and general spread dimensions;

6. Street Equipment and Furniture, a set of five drawings, dated September 19, 21, and 22, 1967, and Proposed Bus Shelter, dated September 19, 1967, as to the establishment of the general character of the overall design of the following items of street equipment and furniture: street sign, sign pole, police call box, fire call box, fire alarm, traffic control box and public telephone, lamp pole base, supplementary lighting fixture, display case, kiosk, bus shelter, bench with back bench without back tree guard and lighting fixtures, trash receptacle, drinking fountain, newspaper vending machine, and subway identification sign; and be it

FURTHER RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby approve the Schematic Design Plan for the Powell Station Plaza as depicted by the Consultants on the following plans:

1. Powell Plaza Plan, Scale 1/16" = 1', dated August 22, 1967;

2. Powell Plaza Section A, Scale 1/2" = 1', dated August 22, 1967;

3. Powell Plaza Section B, Scale 1/2" = 1', dated August 24, 1967, as to the establishment of the general design character of the plaza development as described in the aforementioned report and the basic concepts of the general circulation flow, the relationship with the BARTD Subway Station, the lower level design with the concourse connecting under Market Street with above and commercial activity; the general configuration of the steps, the general location of the escalators, landscaping, planting surface materials, and sculpture, and be it

FURTHER RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby request the Market Street Task Force and the Market Street Consultants to restudy the establishing of the overall character of the functional and spatial development of the station area at Civic Center, giving consideration to a corner location on the south side of Market Street, the redesign plans to be presented to the Joint Planning and Development and Streets and Transportation Committee and the Board of Supervisors, the required land acquisition, street closures, vehicular provisions, pedestrian provisions, subway entrance configuration landscaping, planting, surface materials, sculpture, street equipment, and street furniture; and, be it

FURTHER RESOLVED, That to implement the schematic designs for the restoration of the surface of Market Street and for the adjacent plaza areas, the Board of Supervisors of the City and County of San Francisco does hereby declare as a matter of policy that it is its intention to:

1. Close the following streets to through vehicular traffic at Market Street and their respective conversion into pedestrian areas:

- a. California from Drumm to Market
- b. Bush from Battery to Market
- c. Ecker from Market to 100' south
- d. Annie from Market to 100' south
- e. Powell from Ellis to Market
- f. Eddy from Anna Lane to Market
- g. Leavenworth from McAllister to Fulton
- h. Fulton between Hyde and Market;
- 2. Widen Anna Lane Street from Eddy to Ellis Streets to improve and facilitate traffic circulation, service, and delivery;

3. With respect to all service facilities for buildings abutting on Market Street:

a. Require that on-site facilities be provided, except where existing structural conditions prevent their respective installation;

b. Prohibit vehicular access across sidewalk areas of Market Street;

c. Require that access shall be from streets other than Market Street;

4. Adopt as a matter of City policy the following utility criteria in the design for the restoration of the surface of Market Street;

a. All new utility main systems to be installed in BARTD's rapid transit station areas shall be placed in the roadway of Market Street;

b. All new utility main systems to be installed between stations shall be placed in the roadway area of Market Street;

c. Utility main systems presently located in the sidewalk area and in direct conflict with the proposed tree planting project shall be moved with the exception of the newly installed 4-inch mains between the station areas that was completed in November 1964, however, utility main systems in direct conflict with the tree planting project and for which no disruption of the sidewalk for future maintenance or repair of the utility facility is likely may remain in place in the sidewalk area, and space in the roadway area shall be reserved for future replacement of these utility main systems;

d. Transformer vaults, because of their size and nature, may remain in the sub-sidewalk area and installation of future transformer vaults in the sidewalk area may be permitted;

e. All utility conflicts which may arise in connection with the implementation of the Market Street Design Study Plan shall be resolved by the Director of Public Works;

f. Utility main systems presently being installed or relocated between stations in the roadway area of Market Street in conformance with the Design Study Plan shall not be subjected again to major relocations to accommodate future public or private underground facility installations, if at all possible;

5. Restrict all transit vehicles utilizing the surface of Market Street to vehicles not requiring overhead trolley wires;

6. With respect to subway surface apertures within the right-of-way of Market Street, not permit:

a. Protrusion of skylights for subwayspace through the sidewalk area;

b. Location of station line vent surface grills in sidewalk or pedestrian crosswalk areas, except where provision is so made in the Schematic Design drawings;

7. Select a high-branched and well-formed tree as the type of street tree for Market Street; and be it

FURTHER RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby favor the consideration of a bond issue to finance the restoration of the surface of Market Street and the possible further plaza development in the Civic Center area at the earliest possible date so as to conform with BARTD's construction schedule, the amount of such a bond issue to be ascertained after all other federal, state, and local sources of funds have been considered; and be it

FURTHER RESOLVED, That the Board of Supervisors of the City and County of San Francisco does hereby recommend that the City proceed with the preparation of preliminary design plans for the restoration of the surface of Market Street and for the adjacent plaza areas.

I hereby certify that the foregoing resolution was adopted by the Board of Supervisors of the City and County of San Francisco at its meeting of February 13, 1968.

ROBERT J. DOLAN, Clerk.
Approved: February 20, 1968.

JOSEPH L. ALIOTO, Mayor.
Feb. 23, 1968—lt

5411



